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Branch Line Electrification

WHEN the "Tyneside Venturer" completed its trials under service conditions on the L.N.E.R. in Durham two years ago it became apparent to the public that oil-electric propulsion of trains was a possible (or, as we hope, probable) alternative to steam for certain purposes. Subsequent tests of Armstrong rail-cars under various conditions have borne out the view we then expressed that, where the traffic density is too low to justify the expense of track equipment, the Diesel-electric system satisfies most adequately the needs of modern transport.

These successes were followed by the introduction of similar units by Harland and Wolff on the Belfast and County Down Railway, and now the English Electric Co. has put a unit, with a standard coach as trailer, into shuttle service on the L.M.S. line between Watford and St. Albans.

The impressions we formed of this coach during a trip that we made a few days ago confirm us in our favourable expectations for the future of this form of traction. It has everything to commend it to the travelling public; there is no apparent noise or vibration from the engine, and it is clean. Acceleration, although much inferior to that obtainable with straight electrification, is distinctly smoother and more rapid than the best steam practice allows. We noticed also how easily the motormen (who are ex-steam-locomotive drivers) handled the simple controls after the briefest tuition.

Travelling comfort apart, it is to the saving in operation costs that we must look for repayment of the higher capital cost of the electric system, but our manufacturers have had enough experience with plant built for various duties at home and abroad to produce convincing data on this point. The comparatively poor acceleration, together with the lack of flexibility and heavy maintenance charges of mechanical gearing, rules out the plain Diesel for this class of work. All types can be used for shunting also, and recently the British Thomson-Houston Co. built a unit for the Ford works at Dagenham especially for this duty.

As there are no tunnels on the lines selected, we had no opportunity of observing the effect on the atmosphere (if any) of exhaust fumes. We should not expect it to amount to much in the ordinary tunnel, in view of the high combustion efficiency of the heavy-oil engine, but we think that investigations should be made into this point, if only for the reassurance of the public.

We may have to wait awhile for main-line electrification. Force of circumstances will compel the extension of suburban electrified systems, for, as Sir Hugo Hirst has pointed out in the Press recently, the tendency is for electrification, once tried, to be extended; but we need not await the preparation of larger schemes to do something towards branch-line electrification. There are hundreds of miles of such lines where an improvement is needed to attract passengers. They should provide an opportunity for the Diesel-electric coach, for either permanent or temporary use as local conditions may make desirable, without prejudice to the ultimate issue of straight electrification.

Mr. Parkinson's Speech

As will have been anticipated, Mr. Frank Parkinson's speech to the shareholders of Crompton-Parkinson, Ltd., on Friday last, dealt with a year filled with enterprising developments carried out in pursuance of the board's forward policy. He claimed that the results detailed in the report were a testimony to the wisdom of directing the company's activities into lines of manufacture where new conditions were creating new demands. But he also made it clear that productive capacity in lines of manufacture which were temporarily under a cloud of depression was not being neglected; it was being maintained for the purpose of taking full advantage of the increased business which would come with a return to more normal trading conditions. The Derby Cable Works had been reorganised and extended to meet increased demand, and the new glass factory for the lamp business had

been brought into full production. Mr. Parkinson referred with pride to the progress of their lamp-manufacturing and selling operations. The company has strengthened its reserves, and is conserving its cash resources to meet the increasing capital requirements involved by extending activities. He alluded to the lack of co-operation and co-ordination within the electrical industry, of which one has so often heard in the past, as a contributory cause of electrical manufacturing failing to reach a profit-earning stage and financial stability commensurate with the technical skill required for its direction and the money invested. On this point, some interest attaches to his remark that the board of Crompton-Parkinson, Ltd., is prepared sympathetically to consider every proposal tending to improve the efficiency and profit-earning capacity of the industry as a whole.

Voltage Variation

IN our Correspondence columns during the past two weeks support has been forthcoming for the view expressed by Messrs. W. Kidd and J. L. Carr in their recent I.E.E. paper, and by others in the subsequent discussion, that the voltage on distribution networks can be economically maintained between plus and minus 4 per cent. of the declared pressure. We have two main reasons for agreeing with the view that the present statutory limits should not be extended. The first is that close regulation is more necessary than it ever was, having regard to the development of the heating and cooking load. Secondly, it should be easier to keep within the prescribed margin owing to the development of automatic tap-changing transformers, voltage regulators, static balancers and boosters, and the possibility of giving intermediate feeds on a.c. systems. If the loss in revenue to the supply authority due to poor regulation, which may be anything up to 10 per cent., is a measure of its effect, it is an incomplete one; the influence on the consumer is out of all proportion to this. Permission has been given by the Electricity Commissioners in special cases to increase the range to 5 per cent., but we hope this will not be regarded as a precedent.

Advance, Electricity!

AMERICA, so long regarded as "ahead and well ahead" in electricity consumption, is very much exercised just now by the fact that its prospective generating capacity is far in advance of consumption. A national power policy has been introduced, and a five-point programme, some details of which appear on page 885 of this issue, has as its main objective an "Electrified America." Much, it is hoped, can be done in three years, and all in ten. How to do this sort of thing has been the subject of much deliberation in this country of late. Across the Atlantic there is the desire, if not the ability, to make short shrift of anybody who dares to block the path of progress. Here we say the same things, perhaps differently, but we shall not make the headway that is required if we allow ourselves to be lulled into a state of self-satisfaction because we have reorganised the Council of E.D.A., have appointed an executive chairman, and have indulged in some new advertising propaganda, which, while it may be doing general good, is being subjected to much criticism. An "electrified Britain" will only be brought into being through special effort on the part of nearly everybody in the electricity supply world—it is useless to disguise our recognition of the fact that we have a long way to go and some unwilling horses to harness.

Lamps in Collieries

IGNITION of fire damp is responsible for many times the number of fatalities that can be attributed to electricity. The reports of Mr. J. A. B. Horsley year by year show that electricity becomes safer in relation to its increasing use; but, like Cæsar's wife, it should be above suspicion. At the inquiry into the Grassmoor Colliery explosion Professor W. H. Macmillan said that the breakage of an electric lamp was the "most likely of a large number of unlikely causes of ignition." In order that all steps may be taken to avoid electricity being regarded as a possible cause in the future we would draw attention again to paper No. 80 of the Safety in Mines Research Board, to which we referred in our issue of November 17th. In this paper the effect of the relation between size of lamp filament and the risk of fire-damp explosion due to lamp breakage has been thoroughly investigated.

Abuse of Imagination

WE are afraid that it is too frequently imagined that an outbreak of fire is caused by the electric wiring. Imagination is the creative faculty of the mind; it is sometimes loosely used for "fancy," which may be only a "delusion." This mental picture is sometimes promoted, in the headlines of a daily paper, to the status of a "theory," which is primarily a conception of the causal connection between facts. Such a method of jumping to conclusions would be far less in evidence if the wiring of old buildings (some of which has been in use for more than thirty years, and often at a higher voltage than that for which it was installed) were inspected periodically, as boilers are, by competent engineers and given a clean bill of health for further service.

Municipal Restrictions

A GREAT deal has been said in recent months regarding the action of certain local authorities who have insisted upon the use of electricity by tenants of municipally owned houses. The agitation culminated in the passing of the Gas Light and Coke Company's Act which makes it illegal for authorities to impose such restrictions in the company's area of supply; similar action is contemplated at Brighton. Of course, it might be argued that to compel a tenant to use electricity is for his own good, but all the same the policy is not one to be encouraged. The latest example of this kind of thing comes from Ramsgate, where the Corporation has just refused to allow the Ramsgate and District Electric Supply Co. to install electricity in Council houses, although tenants have asked for it. Ramsgate Corporation owns the local gas undertaking.

Earthing

THE official definition of "efficient earthing" of metal is that the latter shall be connected with the general mass of earth in such a manner as to ensure at all times an immediate and safe discharge of electrical energy. We would emphasise the expression "at all times," as during the prolonged spell of dry weather in the past summer many engineers became alarmed at the rise in the measured value of their earthing electrodes. In some cases earthing became merely nominal and perhaps worse than useless owing to the false sense of security engendered through the existence of connections that normally might be efficient. The article by Mr. T. C. Gilbert on a later page raises some important points, and shows that the earthing problem still awaits a satisfactory solution. Suggestions on the subject from our readers will be welcome.

Satisfactory Figures

A DISTINCT improvement was recorded for November in our electrical export trade, the total of £884,728 being £34,961 higher than the October figure and £90,481 above that of November last year. The most notable advance was made by telegraph and telephone apparatus, which rose by £120,714 as compared with the corresponding month of 1932. Exports of electrical machinery declined, however, as did submarine cables—an ever-varying item. Although the import total was £40,761 higher than October's, it was only £188 above the November, 1932, figure; this was mainly due to increased purchases of telephone and telegraph apparatus—probably radio. The export total for the completed portion of the year is only £180,446 behind that for the corresponding period of 1932, but imports have declined by £425,748 so far. Our monthly detailed table appears in the "Business and Industrial Notes" section of this issue.

Ready for Christmas: Some London Stores and Showrooms

1 and 2. Fire and lighting fittings displays at Harrods. 3. In Whiteley's electrical department. 4. A corner of Selfridge's electrical display. 5. The showrooms of the Battersea Electricity Department. 6. Entrance hall display and (7) an interested group at Magnet House, Kingsway (G.E.C.). 8. One of the Ediswan windows, Charing Cross Road.

Slot Whine in Small Motors. By E. C. Wadlow, B.Sc., Ph.D.

The effect of the number of rotor bars

SMALL squirrel-cage induction motors are used in a number of applications where, silent running being a primary requirement, rotor slot whine may be very objectionable. Several series of experiments, using rotors with different numbers of bars, have been made (see Hobart, "Electric Motors," Vol. II, 1923, Chap. XI), but they were mainly directed towards explaining and overcoming the phenomenon of crawling in very much larger motors. References to noise are few, and deal mainly with the accelerating period.

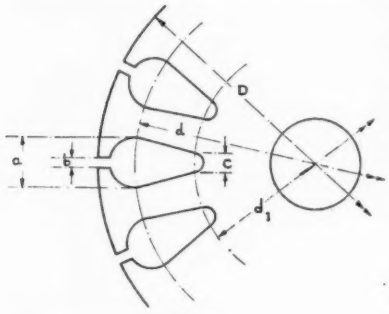


Fig. 1

A short time ago, two small experimental squirrel-cage motors, using condenser phase splitting, and having rotors 1.75 in. in diameter, were found to have a very pronounced slot whine. The number of bars per rotor was seventeen. Experiments on these motors were not continued, as the requirements changed, and a four-pole motor, having one shading ring per pole and a rotor 1.5 in. in diameter, was adopted as more suitable. The number of bars selected in the first instance was thirteen. Slot whine, however, was again very pronounced.

It was decided to determine the effect of using various numbers of rotor bars upon slot whine, and pairs of rotors were constructed, having respectively 14, 15, 16, 17, 18, 19, and 20

TABLE I.

Number of Bars.	D.	d.	d_1.	a.	b.	c.
13 14	1.460	1.250	0.84	0.156	0.032	0.062
15 16 17	1.460	1.260	0.84	0.136	0.032	0.055
18 19 20	1.460	1.275	0.84	0.116	0.032	0.043

All dimensions are in inches.

bars per rotor. In all cases the bars were skewed by an amount equal to their pitch. To reduce the cost of making these rotors only three sizes of slot (fig. 1 and Table I) were employed, these being selected so as to keep as nearly as possible the same total cross-sectional area of conductor over the whole range. The bars and end rings were of pure aluminium, and were sand cast in position round the stampings. The end rings were 0.125 in. by 0.312 in. cross section, and the length over the rotor stampings was 1.25 in. Slot whine

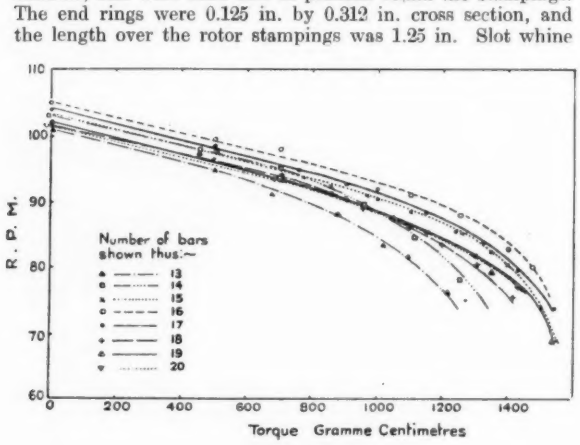


Fig. 2

was very noticeable in all cases where an odd number of bars was used. With even numbers, no slot whine could be heard.

All samples were equally smooth running. Measurements of torque against slip indicated that sixteen bars per rotor gave the best results in this particular motor. While all the rotors were tested in the same frame, and care was taken to maintain bearing sizes, running temperatures and conditions of lubrication as constant as possible, the difficulty of obtaining absolute constancy of test conditions need not be emphasised. The torque was measured at a shaft driven from the rotor shaft through spiral gearing, the reduction ratio being 13.67 to 1. The observations are plotted in fig. 2.

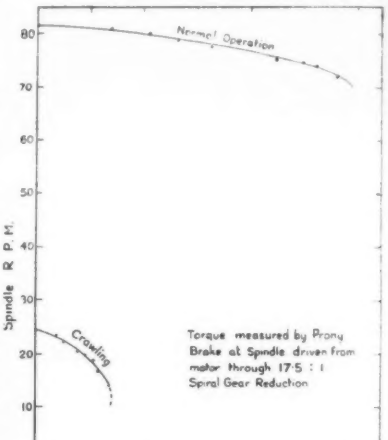
Data from several similar small motors all designed for a duty calling for quiet running and made by different firms have been collected in Table II. It will be seen that opinions vary considerably as to the optimum number of bars, and that

TABLE II.

Motor Reference.	Number of Rotor Bars.	Number of Stator Poles.	Method of Phase Splitting.
A	10	4	Shading rings.
B	13	4	" "
C	13	4	" "
D	14	4	" "
E	15	2	" "
F	17	4	" "
G	17	2	Condenser.
H	18	4	"
I	18	4	"
J	18	4	Shading rings.
K	21	2	Condenser.
L	22	4	Shading rings.

no particular preference is expressed for either odd or even numbers. These motors have been examined at different times during the last three years, and few direct comparisons have been made, but it has invariably been noticed that rotors with an even number of bars have been free from audible whine. Odd numbers, on the other hand, have always been accompanied by whine, sometimes slight, but sometimes very bad.

The results also support the view that there is no relationship between slot whine and tendency to crawl. The rotors and shafts of motors H and I were interchangeable, but those in motor H were made in one factory, and those in motor I were made in another, but to the same dimensions. Those made in the second factory often had a definite crawling speed, at which running was so stable that the torque-speed curve could be determined, as in fig. 3. Rotors made in the first factory could not be made to crawl in any circumstances, even in the stator which gave the data for fig. 3.


Normal Operation
Crawling
Spindle R. P. M.
Torque measured by Prony Brake at Spindle driven from motor through 17·5 : 1 Spiral Gear Reduction
Torque Gramme Centimetres
Fig. 3

This suggests differences in workmanship between the two batches—a view consistent with the results obtained by Hoseason,* who found that, with a crawling motor, "harmonic currents were passing through the laminations from bar to bar of the squirrel cage," and that crawling could be eliminated by insulating the bars from the laminations. His experiments, made on much larger motors, show that "an almost pure speed-torque curve can be obtained from any balanced type of stator winding if the squirrel cage rotor is skewed one stator slot pitch and the bars insulated," and, therefore, indicate that the phenomenon of crawling is independent of the number of rotor bars.

In the small squirrel cage motors at present being discussed, there are usually the same number of stator slots as there are stator poles, and, in consequence, one coil per pole. Skewing the rotor bars as recommended by Hoseason is therefore impracticable, and it is usual to skew them by one rotor slot pitch. Generally, however, these motors do not have to start against a load, and no trouble is experienced due to crawling. Insulation of the bars is therefore unnecessary, which is fortunate, as it would be very difficult to carry out when the conductors are cast into position. Slot whine is a more prevalent defect, and the experiments outlined above suggest that this trouble may be avoided at the design stage by employing an even number of bars in the rotor.

* "Progress in Electrical Motor Development." Paper before Manchester Association of Engineers. Jan. 27th, 1933.

Some Driving Forces in the Industry: Westminster Engineering Co., Ltd.

1, 2 and 3. Messrs. W. Meacher, J. O. Girdlestone (*Elliott & Fry*) and W. Innes (*Elliott & Fry*), joint managing directors. 4. Mr. O. Jones (*Jerome*), Testing Department. 5. Mr. A. W. Way, director. 6. Mr. R. O. Girdlestone (*Raphael Studios*), outside representative. 7. Mr. W. Read, Winding Department

Earthing Electrodes. By T. C. Gilbert, A.M.I.E.E.

The difficulties of securing low-resistance values

MANY engineers claim very low figures for the resistance of their earthing electrodes, but I have never yet been able to secure any of these good positions for work with which I have been concerned. It is usually assumed that an average resistance for a driven rod or pipe is about 50 ohms, although Continental engineers affirm that 100 ohms is a more practicable and likely value. It is the *mean* value that is of importance, and not that measured under the most favourable conditions. I have obtained resistances of over 350 ohms for driven pipes on a system that had been certified about two years before as being of 80 ohms only; even the latter figure should have condemned the system immediately.

I have received permission to use the following particulars of authoritative tests on the earthing resistances of electrodes over a period of one year under approximate practical conditions compiled by the National Physical Laboratory. This information was incorporated in a paper read by Mr. P. J. Higgs, B.Sc., entitled "An Investigation of Earthing Resistance" before the Institution of Electrical Engineers (I.E.E. *Journal* No. 402, June, 1930, and No. 406, October, 1930). So far as I know these represent the only available record of tests taken over a long period, as distinct from isolated practical tests made upon installations.

Electrode No.	Length ft.	Ext. dia. in.	Maximum ohms.	Minimum ohms.	Mean ohms.
16 pipe	6	1	43	36	39
17 ,,	6	1	20	17	18
18 ,,	6	1	21	17	18
23 plate	3×3	1	201	118	141
24 ,,	3×3	3	60	30	39
25 ,,	3×3	6	27	21	24
26 ,,	3×3	6	30	20	24
33 ,,	6×3	1	77	48	60
35 ,,	6×3	8	15	13	14
37 ,,	6×6	6	18	11	15
50 strip	2×25	1	52	18	27
52 ,,	2×25	1	16	11	13

[1] Placed in coke bed 6 ft. long and 1 ft. radius.
[2] Treated with 10 lb. salt dissolved in water.
[3] Plate buried vertically, mean depth 6 ft.
[4] Placed in coke bed.

Many traditional ideas were discounted as a result of these tests. The investigators were concerned with ohmic resistances only; no information is given as to the behaviour of the electrodes—or the influence on the resistance—when heavy currents passed over them. Investigations on the Continent and in America have shown that fault currents flowing over earthing electrodes cause a rapid rise in resistance, even with light currents if long-continued; this has been attributed to the heating and drying of the soil in contact with the electrode.

The figures given by Mr. Higgs may therefore be considered the minimum possible under favourable conditions with the types of electrodes under test. The smallest *mean* resistance recorded was about 10 ohms, and the greatest about 1,000 ohms, but it varied enormously with similarly sized electrodes, which seems to show that it is possible to obtain a wide range of values within a comparatively small area, where the soil is of the same nature throughout. The maximum and minimum values indicate that it is incorrect to assume that the resistance of the electrode will remain indefinitely at the recorded value; even the minimum readings of the electrodes under discussion show their uselessness for practical purposes. These changes, due mainly to seasonal variations, may also be caused by the passage of current over the electrodes. Continental investigations have shown that the increase in resistance during dry and frosty weather may be twelve times the mean, but such weather did not occur during the period of the tests at the N.P.L., in which the greatest recorded variation is three times.

Difficulties Caused by Frost

Frost makes earthing in the Canadian prairie provinces very difficult, as the ground becomes frozen to a depth of from 4 to 6 ft. It might, therefore, be argued that there would be little danger from leakage potentials to cattle standing on practically non-conductive earth, but in the city of Calgary recently cows were killed due to a fault developing in the wiring of the stable, the metal of the conduit being connected to an earth rod which was found to be mostly inserted in frozen ground. Although the general mass of the surrounding ground may be frozen, yet on the immediate surface, where the

animals congregate, there is warmth and dampness, rendering this portion, at least, conductive.

The author of the paper mentioned drew the following deductions from the tests :—

(1) Pipes and strips are about equally efficient, and are much more efficient than plates. Strips would not be used in practice, on account of the cost of excavation, and pipes can be simply driven into the ground. In practice, with the ground remaining undisturbed, an electrode would possess heavier current-carrying capacity.

(2) An earth connection consisting of two pipes spaced about 5 ft. apart and connected in parallel is much more efficient than one pipe of diameter equal to the sum of the two pipes.

(3) A plate of a given amount of metal becomes more efficient the more it is elongated like a strip.

(4) The efficiency of a strip or plate is only slightly increased by burying at depths greater than 2 ft. and 4 ft. respectively. Other considerations, such as that of burying below the frost line or a permanently damp level, would probably demand a greater depth in some districts.

The pipes tested were galvanised iron, the plates wrought iron, and the strips copper; the soil in which they were tested consisted of a top soil above sandy loam (the ground had previously been under cultivation), whilst the various electrodes

Passengers in a New York subway car examining the noise-suppressing equipment which has been installed by the Interborough Rapid Transit Co. The windows and doors are kept shut, and special air-conditioning plant has been provided

were spaced about 20 ft. apart. The minimum resistance values were recorded mostly in November, when the ground was wet following a period of heavy rains, and the maximum values in September, after a spell of very dry weather, rather like our experiences this year, but not for so prolonged a period; all seasonal variations were less for those electrodes that were buried most deeply.

The results of the tests bear out my contention that leakage protection by connection to earthing electrodes is to all intents and purposes impracticable, and that some improved form of protection should be sought. Reliance upon such devices is, however, common in both England and America, but improved methods have been developed and adopted in rural electrification schemes on the Continent.

Electrodes in Parallel

It is sometimes stated that the resistance of electrodes can be substantially reduced by multiplying their number and connecting them in parallel. This undoubtedly reduces risks from potential gradients, but it must not be forgotten that electrode resistances connected in this way do not follow the ordinary simple rules for resistances in parallel. For instance, if one driven pipe electrode has a resistance of 100 ohms it does not follow that two such electrodes connected in parallel would show only 50 ohms; the figure might be something between 80 and 90 ohms; and even this slight lowering of the value would depend upon the spacing of the pipes.

Some very interesting work in this connection has been carried out by Mr. G. F. Tagg, who has prepared a series of graphs showing that if the resistance of a single rod, 10 ft. long and ¾ in. in diameter, be taken as 100 ohms, then the use of forty such rods in parallel, spaced 5 ft. apart, would result in an overall resistance of 14.5 ohms; spaced 10 ft. apart it would be 8.5 ohms; 20 ft., 5.5 ohms; 30 ft., 4.5 ohms; 40 ft., 4 ohms; 100 ft., 3 ohms. It is clear that little is to be gained from more than forty rods connected in parallel, and at a spacing of more than 30 ft. Even so, these values are affected by seasonal variations, and are based upon the presumption that a single rod will show no higher resistance than 100 ohms, whereas in practice single electrode resistances are often higher than this.

The extensive wiring necessary for forty rods in parallel spaced about 40 ft. apart would be expensive, and the result, about 4 ohms, would not justify the cost, except possibly for the protection of high-voltage lines. On low-voltage circuits this value is unwarrantably high, as isolation could not be effected on any circuit protected by fuses with a higher rating than 25 A.

In practice some of the forty rods would be of much lower resistance than the remainder, as is clearly indicated in the results of the N.P.L. tests; the greater part of any fault current would therefore flow over these few selected electrodes and cause a rapid rise in their resistance until some sort of equilibrium were obtained in relation to the remainder. It cannot be assumed, in my opinion, that the theoretical value of 4 ohms could be maintained for any length of time, as all the good electrodes would tend to become bad, whilst the bad ones would be unaffected. This would certainly occur if this extensive electrode system were utilised for the multiple earthing of a neutral line.

Mr. J. D. Noyes, in a pamphlet entitled "A Discussion of Protective Grounding," issued by the Detroit Edison Co., suggests that there is no real information available for the engineer faced with difficult earthing problems, and that nobody is apparently worrying about the matter at all.

Reduction of Electrode Resistance

No mention has been made of the various means resorted to for the reduction of electrode resistance, the commoner of which are—burying the electrode in coke, in order to retain as much moisture in the vicinity of the electrode as possible, and saturating the surrounding soil with a solution of common salt. The tendency to-day is to abandon the buried electrode in favour of the driven pipe or rod, and the first of these remedies is difficult to apply; the second is sometimes recommended, but it will be seen from the tables that have been given that it seems hardly worth while to treat a driven pipe in this way, as although the resistance to earth was halved—for a period—yet still the resistance remained far too high for all practical purposes (compare electrodes Nos. 6 and 8).

The ultimate benefit of burying a plate in coke has been questioned recently, as it very frequently results in corrosion—not necessarily of the electrode itself but, equally important, of the copper conductors connected thereto. No figures are given in the above table as to the effect of burying an iron plate in coke, but one pipe was so treated (compare electrode No. 7 with No. 6). The resistance was halved, but all the advantages of employing driven pipes disappear if the ground has to be excavated to prepare a coke bed. The resistance of a copper strip was considerably reduced by burying in coke, but its resistance still remains at an unworkably high value (compare electrode No. 52 with No. 50).

The Life of Buried Copper Strand

To refer very briefly to the investigations that have led to doubts as to the advisability of burying electrodes in coke, some specimens of copper stranded conductors employed as earthing conductors on an a.c. distribution system were recovered after a period of twelve months. These conductors had been buried in coke breeze, and the surface water from the sub-station building was drained to the points where the copper plates were buried. It was found that considerable corrosion of the copper had taken place, and in one instance the 0.0775 sq. in. stranded copper conductor had disappeared. The corrosion all took place on sections surrounded by coke breeze, whilst sections in clay were not affected.

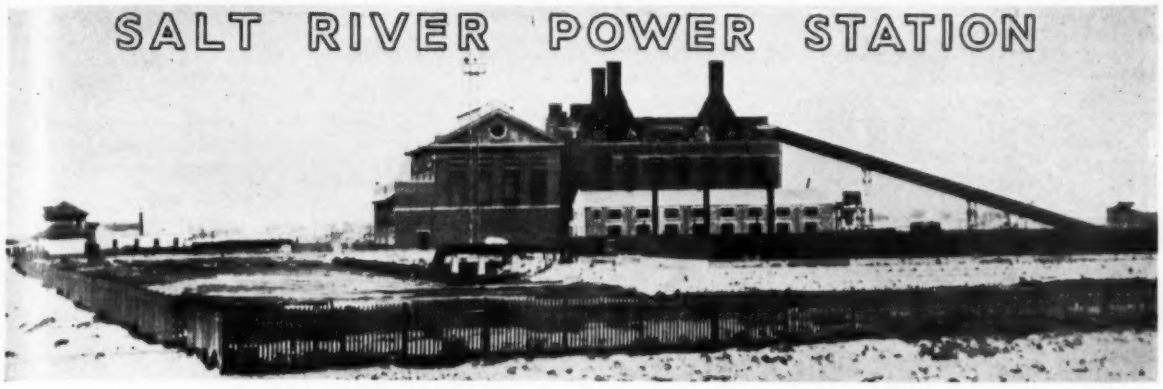
Doubt seems to exist as to whether the trouble is due to chemical causes or whether it may be assisted by earth leakage currents, probably purely vagrant and not connected with the distribution system at all. Most samples of coke contain a certain amount of ammonia, which rather lends support to the chemical theory.

The point I desire to make is this: if burying an electrode in coke does not result in the general lowering of the resistance to a workable value, is it worth while risking early corrosion in this way? Iron plates are now more commonly used than copper, yet the conductors to these plates are usually of copper, and the loss of these by corrosion can be very serious.

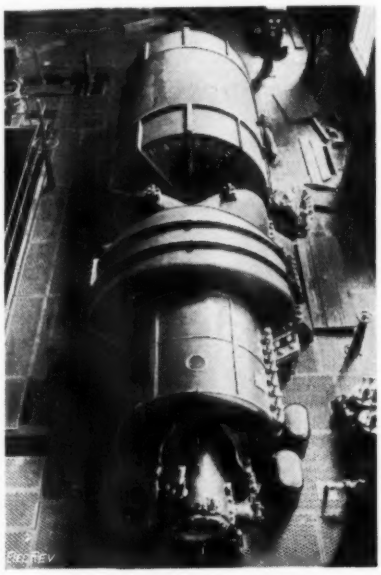
The complexity of the whole earthing question indicates a fruitful field for research, as earthing troubles are being experienced in every rural extension in the country. No reliance is—or can be—placed upon present methods, yet the desirability of efficient leakage protection is emphasised on all sides.

I consider that a case exists for the complete revision of earthing methods in rural areas, and recommend that this should be along the lines that have already been indicated in these columns, following successful Continental practice.

SALT RIVER POWER STATION



THE South African Electricity Supply Commission's Salt River power station has been in commercial operation since February, 1928. Its main load has been the electrically operated trains on the Capetown southern suburbs railway system, the Salt River railway workshops, 33-kV supplies in the rural areas (including Paarl, the Cape Explosives Works and Somerset West, Malmesbury, and Stellenbosch), and consumers in and around a number of outlying townships taking supplies from 380-V distribution networks. The power station has operated almost continuously in parallel with the Capetown Corporation's Dock Road power station; the two stations have been of mutual assistance to each other in dealing with abnormal loads and breakdowns at either.



A plan view of the new set

The Capetown undertaking has taken advantage of the Salt River station to augment the supplies from Dock Road to its transmission and distribution system in the southern suburbs, in exchange for which the Dock Road power station has been supplying the requirements of the Table Bay docks, normally a consumer of the Commission. The two undertakings, while being interconnected, have virtually been supplying the needs of their own consumers separately without purchasing supplies in bulk from each other.

Not long after the City Council introduced its hire-purchase scheme in September, 1930, it became evident that more generating plant would be required to meet the rapidly increasing demands of domestic consumers in Capetown. Electric ranges alone were being installed at the rate of 150 to 200 per month, and the cooking and heating load generally began to increase the daily peak loads at both the Dock Road and Salt River stations. It was decided that the most economical method would be to operate both power stations as a single producing unit and to install 40,000-kW of additional plant at the Salt River station. An agreement to this end was entered into last year between the Commission and the Council. This, in the words of the brochure "Ten Years," recently published by the Electricity Supply Commission, is "symbolic not only of the policy of co-ordination in electricity production . . . but also of the spirit of co-operation which has always existed between the City of Capetown and the Commission."

The existing generating plant in the Salt River station consisted of three 10,000-kW Howden-Zoelly single-cylinder turbines with English Electric alternators generating at 11 kV and four Babcock & Wilcox water-tube boilers with a normal rating of 60,000 lb. per hour at 270 lb. per sq. in.

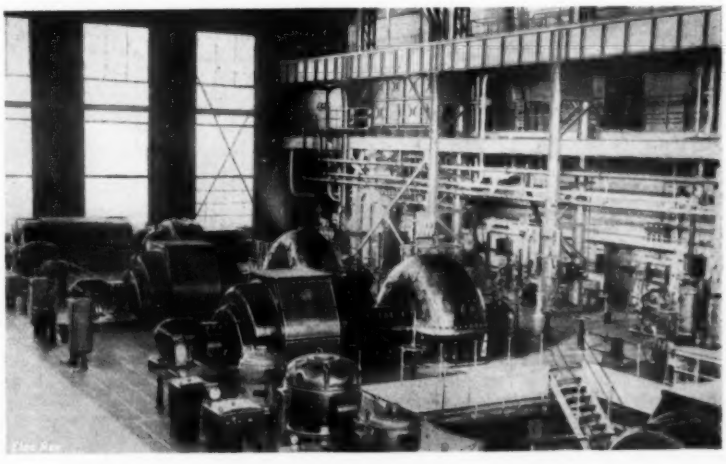
New Boiler Plant

The new boiler plant has been supplied and erected by Messrs. Reynolds, Sons & Partners (Pty.), Ltd., of Johannesburg, and consists of four Babcock & Wilcox cross-drum water-tube boilers with an evaporative capacity of 100,000 lb. of steam per hour at economical output, and 131,000 lb. at maximum continuous output. Steam conditions are 425 lb. per sq. in. (gauge), and 750 deg. F. They are fired by travelling-grate stokers, with chutes of the traversing type fed from the existing bunkers. Each of the two stoker units is driven separately through chain gearing by a totally enclosed B.T.-H. 2½-h.p., 1,000-r.p.m. s.c. motor.

The side and rear walls of the furnace are of the Bailey water-cooled type; the front wall is of firebrick of Bigelow construction. The water-cooled walls have an effective surface of 604 sq. ft., and the combustion chamber has a volume of 4,350 cu. ft. Each boiler has a total heating surface of 10,823 sq. ft. The superheater, which is situated between the two banks of boiler tubes, is of the interdeck type with four steam passes.

The Babcock & Wilcox air preheater is of the sectional-plate type, having a total heating surface of 10,240 sq. ft. Part of the air can be made to by-pass the heater when the boiler is working at low loads or when the atmospheric conditions make it inadvisable to run with low outlet gas temperatures. Air is heated from 110 deg. F. to 266 deg. F. at economical output, and to 297 deg. F. at maximum continuous output. Each boiler is fitted with a Foster gilled-tube economiser with a heating surface of 4,914 sq. ft. for heating the feed water to 330 deg. F. and 342 deg. F. at economical loading and m.c.r. respectively.

The mechanical draught plant for each boiler consists of two forced-draught, one induced-draught, and two secondary-air fans. The f.d. and i.d. fans are installed on the roof of the boiler house and the secondary air fans in the ash-conveyor basement. The "Sirocco" double-inlet induced-draught fan, of Messrs. Davidson's manufacture, draws 80,000 cu. ft. of gas per min. at 350 deg. F. It is driven by a B.T.-H. 160-h.p. pipe-ventilated 750-r.p.m. s.c. motor through a Vulcan-Sinclair hydraulic coupling.



The interior of the Salt River station with the new 20,000-kW set in the background

The forced-draught fans are of the turbo-vane type, manufactured by James Howden & Co. Each fan is driven by a B.T.-H. 50-b.h.p. pipe-ventilated 1,000-r.p.m. s.c. motor. The quantity of air delivered with the motor running at constant speed can be varied by adjustable vanes at the fan inlets. Each fan delivers 48,000 cu. ft. of air per minute at 110 deg. F. The secondary air fans are of the "Sirocco" type, each discharging 12,800 cu. ft. of air per minute at 300 deg. F., and driven by a totally enclosed 3.5-h.p., 1,000-r.p.m. B.T.-H. motor.

Interconnection of Old and New Plant

Each boiler is fitted with three 3-in. high-lift spring safety valves set to blow off at 458 lb. per sq. in.; a 10-in. steam stop valve; and a 3-in. high-lift spring safety valve on the superheater outlet branch, all of Messrs. Hopkinson's manufacture. Each boiler also has a Copes' automatic feed-water regulator.

On an instrument panel is mounted the following equipment for each boiler: (1) a 12-point Cambridge distance temperature indicator connected to the superheater steam outlet, to the water entering and leaving the economiser, and to various points on the air heater; (2) a Bailey combustion meter arranged to indicate, record, and integrate the hourly flow of steam, to indicate and record the equivalent air flow, to indicate the temperatures of the gases leaving the air heater and of the steam leaving the superheater, and to indicate the furnace draught; (3) a Siemens-Schuckert CO_2 indicator connected to the outlet flue; (4) a 5-point Bailey draught gauge; (5) a Pneumercator distant water level indicator of Kelvin Bottomley and Baird make; and (6) push buttons for controlling the starters of the fan motors and the weirs for the oil in the hydraulic couplings. A Lea coal meter with a coal flow indicator is fitted to each stoker unit.

The old and new steam systems are connected through a reducing valve interposed between the steam receiver of the new turbine and that of the adiacent 10,000-kW turbine. On the 425 lb. per sq. in. side of this valve there is an isolating valve and on the lower pressure side there are two relief valves which are capable jointly of passing 350,000 lb. of steam per hour at 270 lb. per sq. in. The automatic reducing valve was made by David Auld & Sons, and the two relief valves by Cockburns, Ltd.

The ash-handling plant was supplied by International Combustion S.A. (Pty.), Ltd., and erected by Messrs. Geo. Powis & Co., of Capetown. It is similar to the plant originally installed and is of the drag-link type operating in a water-trough into which up to 6 tons of ash per hour is discharged continuously.

One steam turbine-driven and two electrically driven feed pumps by Messrs. G. & J. Weir, Ltd., are installed. The turbine pump runs at 4,500 r.p.m. and has a discharge capacity of 550,000 lb. of water per hour against 610 lb. per sq. in. with a positive suction head of 27 ft., with a water temperature varying between 170 deg. F. and 180 deg. F. The electrically driven pumps are coupled to direct-started totally enclosed, fan-cooled, 325 h.p., 2,900-r.p.m. s.c motors by Messrs. Laurence, Scott & Electromotors, Ltd. The pumps each discharge 275,000 lb. per hour against 500 lb. per sq. in. with a positive suction head of 5 ft.

The Turbo-alternators

The first of the two turbo-alternators has been manufactured and erected by Messrs. C. A. Parsons & Co., Ltd.; the m.c.r. is 20,000 kW, and the economical output 16,000 kW at 3,000 r.p.m. The turbine has a single cylinder and is of the reaction type. Normal stop-valve steam conditions are 400 lb. per sq. in. (gauge). The high-pressure end of the turbine casing is constructed of cast steel and the low-pressure end of cast iron. There are thirty-eight stages and forty-four pairs of blade rings which, except for those at the low-pressure end, are of the "end-tightened" type which allows of any desired clearance over the blade tips without permitting any sensible leakage of steam from row to row. The last row of rotor blades is fitted with anti-erosion shields. The blading is of stainless steel except on the last row of the rotor, which is of mild steel. The peripheral velocity of the blades at the l.p. end is 875 ft. per sec. The distance between the bearings of the rotor shaft is nearly 15 ft.

Steam is extracted after the 27th and 33rd stages for feed heating in two surface-type heaters at 33 and 6.5 lb. per sq. in., respectively.

A Caird and Rayner feed water evaporator supplied with steam at 33 lb. per sq. in. is capable of dealing with 7,460 lb. of make-up water per hour at the economical load of the turbine. The two-pass condenser has a cooling surface of 22,000 sq. ft., and requires 14,300 gal. of cooling water per minute at economical load.

Two air ejectors each requiring 1,475 lb. of steam per hour to extract 80 lb. of dry air discharge into the condenser; a third ejector, provided for quick starting, discharges to atmosphere. There are two electrically driven extraction pumps, each driven by a 35-h.p. 1,440-r.p.m. motor, which deal with up to 367 gal. per min. against a head of 120 ft.

A multiple-point distance temperature indicator of the Cambridge Instrument Co.'s make shows the temperatures at the inlet to the steam chest, exhaust, condensate and feed water (at various points), circulating-water inlet and outlet, and condenser air suction.

The Alternator

The alternator is wound for 33-kV between phases. The stator conductors, which are embedded in ninety semi-enclosed slots, are formed on the same principle as a triple-concentric cable, there being three conductors per slot. The insulation between the concentric conductors is approximately 0.2 in. thick. The shields over the end windings are made of a fibrous non-conducting and non-magnetic material to eliminate eddy currents in the end shields. The rotor body and shaft is a single solid forging 18 ft. long between bearing centres with a maximum diameter of 34 in. Ventilation is on the closed air circuit system.

A Parsons 1,000-kVA oil-immersed self-cooled star-star transformer, direct-connected to the alternator terminals, steps down the voltage to 380 for the auxiliaries. The alternator and the unit transformer are protected on the Merz-Price circulating (balanced) current system; the unit transformer is protected further with over-current and earth-leakage relays on its h.v. side, all of which equipment is arranged to trip the main and neutral circuit-breakers, the field switch and the l.v. transformer switch. The 33-kV bus-bars are connected to the 11-kV system by three 6,000-kVA transformers.

The new switchgear is of Messrs. A. Reyrolle & Co.'s manufacture and has been installed by that company as an extension to the 33-kV switchboard in the step-up sub-station. It comprises panels for the generator, three feeders, two bus-couplers and skeleton panels. All breakers have a rupturing capacity of 500,000 kVA and are electrically operated from the control room in the power station.

A 5-ohm metal-grid neutral-earthing resistance is connected to the star point of the stator windings through a remote-controlled Reyrolle circuit-breaker. Reyrolle's also supplied four oil-immersed 380-V ironclad fuse boards in a switch chamber below the firing floor of the boiler house for controlling the boiler-house auxiliaries.

The second Parsons 20,000-kW set is expected to be in commission about this time next year. The installation of this set necessitates extending the power station building to house it, and this work has already been put in hand.

Heat Transfer Between Pipes and Air

THE manner in which heat transfer between metal pipes and a stream of air takes place has been investigated at the National Physical Laboratory, and the results are incorporated in the paper, by Dr. Ezer Griffiths and Mr. J. H. Awbery, which was read at the Institution of Mechanical Engineers in London on December 15th.

At temperatures up to 90 deg. C., when the pipe is placed longitudinally along the direction of the air stream, the heat loss is greatest at the section where the air first meets the pipe, and gradually falls off along the pipe. If the air is artificially made turbulent the loss from all sections is increased, the greatest change being at the first section. The heat loss from a longitudinal pipe is of the order of one-half that from a transverse pipe.

With a bank of pipes in square formation, the second layer of pipes met by the air loses more heat than the first layer, the third layer losing the same as the second. It is suggested that this is due to the eddy motion set up in the air when it passes the first layer, no further increase of the eddy motion occurring afterwards. With a band of pipes in diagonal formation the first section again loses least heat. In this case not only is the loss in the second row greater than that in the first, but there is a further increase in passing from the second to the third row, after which the coefficient is constant.

When air impinging on a band of staggered formation is artificially made turbulent, the heat loss from every row is increased to such an extent that the first row loses more heat with turbulence than the third row does without turbulence. At pipe temperatures below zero the results are similar when the surface is dry, but when the water is dripping off the heat transfer may be 30 per cent. greater than the normal. The insulating value of snow and ice on the pipe is compensated for by the greater area presented to the wind, since the effective pipe diameter then becomes larger and has a higher surface temperature than that of the metal.

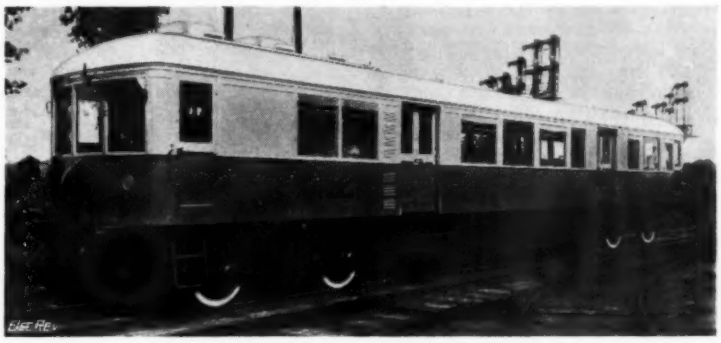
A New Diesel-electric Train

The English Electric rail-coach for branch lines

THE most suitable alternatives to the steam locomotive depend upon the conditions prevailing and the requirements of the service. Each case has to be decided on its merits.

In the design of the rail-car which is now running on the Watford-St. Albans branch of the L.M.S. Railway, the English Electric, Co., Ltd., has drawn on its long experience in the building of vehicles propelled on the i.c.e.-electric system and has carried out the construction entirely within its own works. The new coach is hauling a standard 27-ton (tare) trailer coach. Its leading particulars are: length over buffers, 62 ft. 10¼ in.; width overall, 8 ft. 11⅛ in.; height overall, 12 ft. 11¼ in.; seating capacity, 53; weight, without passengers, 37¼ tons; maximum speed, 60 m.p.h.

The body is built up on an underframe of rolled steel sections riveted together. The bolster at the engine end is carried from four swing links with nests of steel spiral springs and rubber shock absorbers. Driving controls are fitted at each end of the coach and also at the far end of the trailer, and the equipment permits of multiple-unit working.



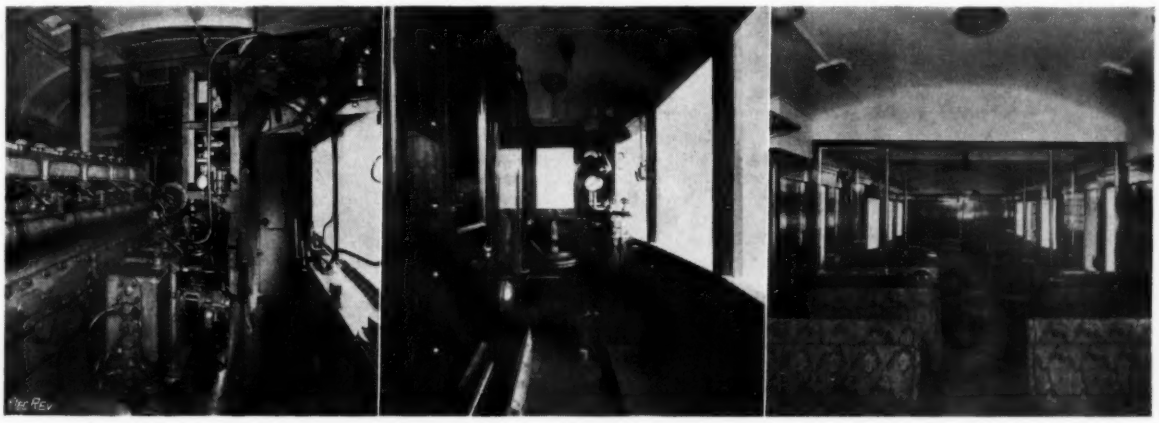
A general view of the 200-h.p. rail-car

The bogie under the engine compartment is of plate-frame construction and carries the two axle-hung motors; the trailing bogie is built up of steel sections. Both bogies are fitted with S.K.F. bearing axle boxes. The vacuum brake acts on all wheels and an electrically driven exhauster is mounted in the engine compartment.

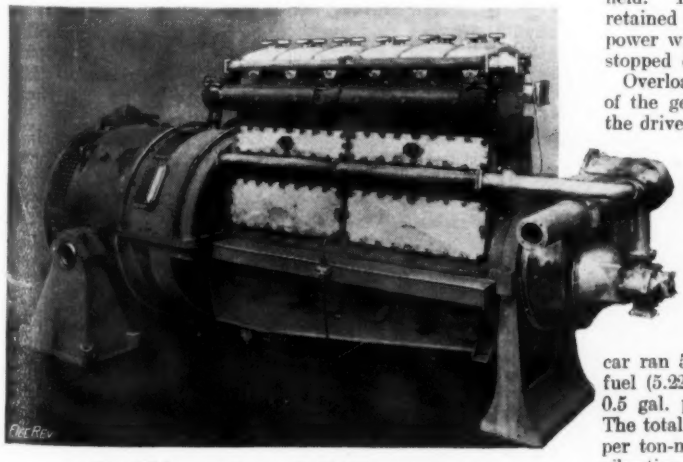
The engine is of the vertical four-stroke, mechanical-injection, cold-starting type with six 6-in. by 8-in. cylinders. It develops 200 h.p. at 1,500 r.p.m., with a maximum of 220 h.p. for fifteen minutes; provision is also made on the controller for running at 1,200 and 900 r.p.m. Engine speed is controlled by solenoid operated valves; these admit lubricating oil under pressure to cylinders which alter the governor control spring settings and the timing. Should the pressure of the lubricating oil fail, the engine is automatically shut down. The engine and 135-kW generator are carried in trunnions which give a three-point suspension.

Power unit bearers and their fixing bolts are insulated with rubber from the underframe, minimising the noise and vibration transmitted along the coach. The exciter is mounted separately and is chain-driven. The reverser, motor contactors, and battery auto cut-out for the control gear are assembled on a framework over the main generator. For providing steam heat to ordinary coaches used as trailers, a boiler fired with fuel oil has been installed.

Operation of the vehicle requires one man only, the master controller being fitted with a "dead-man" button; the engine compartment needs no attendance during running. A push-button switch (by which the generator is motored from the battery) starts the engine from the driving position. Movement of the master-controller handle advances the engine speed from idling in three steps and finally weakens the motor field. If the handle is moved back the weak motor field is retained as far as the idling position, thus economising engine power with maximum electrical output. The engine can be stopped during coasting and at stations.



Left, the engine compartment (looking towards generator); centre, one of the driving compartments; right, the passenger accommodation



The 200-h.p. engine and 135-kW generator

Overloading of the engine is prevented by the arrangement of the generator windings and the control of excitation and the driver has only to observe two signal lamps which indicate that the lubrication and water circulation are in order.

The railcar was previously run on the Warwick-Daventry-Northampton branch of the L.M.S. Railway, either as a single unit or with a trailing load of cattle trucks or horse boxes. Diesel-electric vehicles are available for twenty-three hours a day, but the need for working in with the existing time tables limited the service to fifteen hours per day for five days per week. During five weeks the railcar ran 5,880 miles at an average of 6.26 miles per gallon of fuel (5.22 miles including coach heating, which requires about 0.5 gal. per hour), including shunting and shed movements. The total engine fuel consumed varied from 0.0356 to 0.0380 lb. per ton-mile. Steps taken to avoid transference of noise and vibration from the engine compartment have proved effective.

The Electricity Supply Outlook. By R. S. H.

Estimated growth of load for the next seven years

THE Weir Report of 1925, which led to the setting up of the Central Electricity Board, referred to the production of electricity in 1940, when the annual sales by authorised undertakers were expected to reach 21,400 million kWh, or 500 kWh per head of population. The "Supplementary Particulars" supporting the area draft schemes estimate a sale of 20,500 million kWh in 1940-41, while the seventh annual report of the Electricity Commissioners published nearly three years later states that the Commissioners had estimated that in 1941 sales would reach at least 19,160 million kWh. The completion of the grid makes it appropriate to consider whether these estimates are likely to be realised.

The consumption of electricity may be sub-divided into four main classes, *viz.*, (*a*) industrial, (*b*) traction, (*c*) commercial, and (*d*) residential, which differ greatly in the rate of growth of consumption. In estimating the minimum sales of electricity by authorised undertakings in 1940-1, the returns of the Electricity Commissioners will be used for 1923-4, 1928-9, and estimates calculated from the latest figures available for 1933-4; the first two years were normal years for the post-war period in that there were no exceptional movements due to industrial disputes and the like, and the third year makes possible a comparison of the progress during two periods of five years.

The industrial load is at present the heaviest, but its rate of growth is the most uncertain. The mean annual increase in industrial consumption from the supply industry's mains was 9.6 per cent. in the first period, as against 3.1 per cent. in the second period, towards the end of which sales showed small decreases. The industrial load in the future will depend on whether (i) British industries increase their outputs and become prosperous, and (ii) any substantial change over from private plant takes place. The answers depend mainly on matters outside the control of the supply industry.

Although business is no longer declining here, yet, until some rough stability has been reached throughout the whole world, progress will be slow. It appears unlikely that there will be any substantial lowering of tariff levels during the next seven years, and some of our older industries, such as shipbuilding, coal and cotton, will not regain their former levels of output, although there may be some improvement in their present positions; at the same time the new British tariffs against imports are likely to lead to growth of output and hence of electrical consumption in many other industries and also in agriculture.

Private or Public Supply?

The arguments in favour of a supply from the public mains may be summarised as follows:—1. Public undertakings can ensure continuity of supply more cheaply, as the cost of reserve plant can be spread over different classes of consumers. 2. They can run economical plant at full load for long periods, using the less efficient plant only at peak. When the grid is in full operation new plant will be installed year by year owing to the growth of load on the public systems. 3. They can employ full-time experts on small sections of their work, such as fuel purchase and treatment. 4. Their running costs may be lower through the connection to the grid of water-power and similar high load-factor plant. 5. Public supplies can profitably be sold at little over running costs for off-peak loads. 6. They are often more flexible for dealing with increase or decrease in loads, whereas with private plant some notice must be taken of the plant available, the standard size of machine, &c. 7. In general, public supplies do not involve the investment of the industrialists' capital over a long period of years.

The main points on the other side are as follows:—1. The installation of private plant at the point of demand eliminates charges due to mains systems. 2. Private plants are not subject to the frequency-standardisation levy which, according to the Electricity Commissioners' twelfth annual report, may amount in a few years' time to £1,000,000 per annum to be recovered from authorised undertakers. 3. Industrial undertakings under the "De-rating" Act are relieved of 75 per cent. of the assessed local rates chargeable against them, but no relief is granted to authorised supply undertakings. 4. Cheap fuels or waste resulting from the business carried on may be burned and steam may be available from their processes. 5. The works machinery can be so run that the plant is more or less continuously on full load. If continuity of supply is not essential no reserve plant need be carried; overhauls can be carried out overnight, during week-ends or at holiday times, and the works or sections of the works can be closed in case of breakdown.

In general, a proper standard costing system would show that private supply is cheaper only where the cost of transmission outbalances the difference. At the same time, as the ELECTRICAL REVIEW has pointed out, this advantage is not available to the user of public supplies unless the supply authority's tariffs accurately reflect the actual costs.

Electricity will be increasingly adopted as supplies become cheaper, old plant has to be replaced, and the prices of motors and other electrical equipment fall with the decrease in the cost of copper, greater output, and standardised voltages and frequencies.

As a minimum the annual increase in industrial sales may be estimated at 3 per cent. per annum, giving 7,000 million kWh in 1940-41, as against the estimated figure of 5,700 million for 1933-34.

The Traction Load

Over the first five-year period the average annual increase in the traction load was about 11.8 per cent., as against 5.2 per cent. in the second period. There will be little extension of the tramways in the future except for odd branch lines to complete existing systems, but trolley 'buses are being substituted in many towns and transport undertakings will be able to obtain supplies at or near the grid price for the area.

Main line electrification will probably not be embarked upon for many years, despite the success of the Southern Railway's suburban passenger-train electrification. Any substantial extension of electrification is most likely to be on London suburban lines.

The increases in traction sales during the past decade represent the net effect of the Southern Railway electrification less decreases due to the closing down of various small tramway systems. The mean annual increase may be estimated at 3 per cent. as a minimum, so that the sales of 900 million kWh in 1933-34 will become 1,100 million in 1940-41.

The Commercial and Residential Loads

Comprehensive statistics as to the commercial load (in shops and similar premises) are lacking even in the Commissioners' publications, which under the heading "Lighting and domestic" show a combined figure for the commercial and residential loads. The consumption and total revenue of this class have steadily increased even in the year of the general strike and in the recent years of industrial depression. The average annual increase in sales was 17.1 per cent. in the first period and 15.4 per cent. in the second period.

After the extension of mains to a new district there is at first a higher proportion of sales for commercial purposes, as electric lighting and signs are adopted more immediately by the shopkeepers, but when the domestic load is developed properly it dwarfs the commercial load. The proportions of the commercial and residential loads in millions of kWh is estimated in the accompanying table.

MILLIONS OF kWH SOLD AND MEAN ANNUAL PERCENTAGE INCREASE.

Year.	Power.		Traction.		Residential.		Commercial.		All Classes.	
	Total.	Inc. %	Total.	Inc. %	Total.	Inc. %	Total.	Inc. %	Total.	Inc. %
1923–4 ...	3,100	—	420	—	500	—	500	—	4,500	—
1928–9 ...	4,900	9.6	710	11.8	1,200	19.2	1,000	14.9	7,800	11.6
1933–4 ...	5,700	3.1	900	5.2	2,700	17.6	1,700	11.2	11,000	7.1
1940–1 ...	7,000	3.0	1,100	3.0	8,600	18.0	3,800	12.0	20,500	9.3

The minimum rate of increase is taken at 12 per cent. per annum, giving a total consumption in 1940-41 of 3,800 million kWh; this figure is likely to be exceeded if the price of apparatus and wiring falls to any considerable extent and if there is a substantial development of off-peak heating of shops, offices and public buildings at special prices.

Many of the Commissioners' official publications, such as the Report on Tariffs and the statistical book, appear to regard the residential load as useful merely for filling in the valleys of the industrial load which suggests that it is a minor matter. The residential load is most developed in areas where the industrial load is small, and yet the undertakings often show a greater profit than others with a predominating industrial load.

In time, 90 per cent. of the homes in Great Britain should be taking for domestic purposes an average of 2,000 kWh per annum, each making the total residential sales 16,200 million kWh, as compared with the present sales of 2,700 million kWh. Many small working-class homes are taking over 1,000 kWh per annum, but it is of no use charging more than 1d. per kWh on a flat rate or ¾d. per kWh on a two-part tariff, for even in country districts the total cost becomes too high so that the most perfect advertising is futile. In this con-

MEETINGS AND DISCUSSIONS

Current Topics and Opinions Expressed at the Institutions

High-voltage Test Phenomena

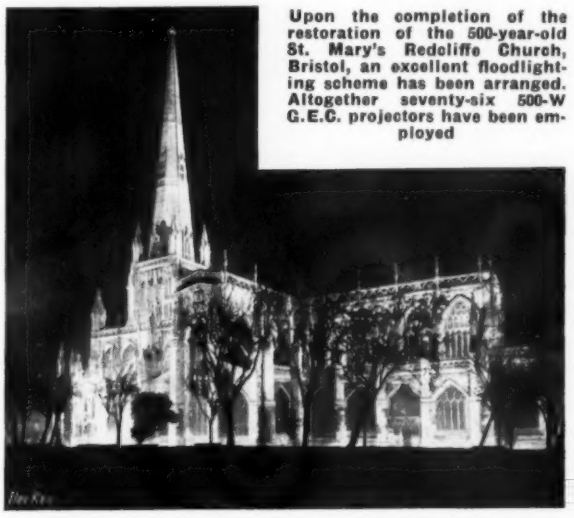
SOME of the electromagnetic phenomena which may be encountered in the operation of high-voltage testing equipment are discussed in the paper, by Mr. B. L. Goodlet, which was read before the INSTITUTION OF ELECTRICAL ENGINEERS in London on December 21st. Although secondary in magnitude these effects are not secondary in importance, since they may vitiate the accuracy of important tests and lead to the loss of much time and money. Theoretical deductions are throughout supported by actual experimental results.

The first part of the paper deals with wave-form distortion in the usual single-phase normal-frequency transformer equipment. The factors considered include core saturation, capacitance loading, and induction-regulator and alternator characteristics. Information is also given as to the effect of wave-form on breakdown voltage and dielectric losses. This section is not intended to do more than prove that dielectric-loss tests by standard methods are liable to be erroneous if the voltage wave is seriously distorted. The matter is unlikely to be pursued farther, since for practical purposes it is better to eliminate an error than to attempt to correct for it.

In the second part of the paper the author examines a perennial source of annoyance to testers which does not appear to have yet been explained in a quantitative manner. Transient over-voltages in testing transformer circuits, produced by switching and by discharges in the load, are discussed in detail. The presence of such transients can be detected and methods of avoiding errors are indicated.

Oscillations in rectifier circuits are also considered, which matter might well form the subject of a separate paper. The theory outlined by the author provides a valuable basis for calculating the load regulation of rectifier sets, always a difficult matter to predetermine.

The third part of the paper deals with wave-form distortion in the impulse generator. Special attention is given to the superimposed oscillations introduced by load capacitance and by measuring circuits. The theory of the oscillation transformer is developed as a special case of the impulse generator, and test results are given for an actual equipment.



Upon the completion of the restoration of the 500-year-old St. Mary's Redcliffe Church, Bristol, an excellent floodlighting scheme has been arranged. Altogether seventy-six 500-W G.E.C. projectors have been employed

In Search of an Effective Dock-lighting System

CONCLUSIONS arrived at as the result of a general survey of dock-lighting recently undertaken by the National Physical Laboratory for the Department of Scientific and Industrial Research are embodied in the paper by Mr. J. S. Preston which was read at a recent special meeting of the ILLUMINATING ENGINEERING SOCIETY in Liverpool.

It is suggested that the ideal lighting system for dock approaches would consist of units situated not too far apart, say, not more than about six times their height, and giving, as a system, an illumination on the horizontal plane not varying in a ratio of more than, say, five or six to one along the line joining the units. The actual units may consist of refracting or reflecting fittings suitably designed for the particular dimensions used; or the British Standard industrial fitting may be used. The disadvantages of this reflector as regards its non-directional quality are largely outweighed by the complete cut-off, which makes glare almost non-existent.

Warehouse lighting is equivalent to factory illumination for non-fine processes, which subject has been studied exhaustively in the past. In general, for economic reasons, there is a tendency to under-estimate the number of units required for a given warehouse. Whenever possible, it is a distinct advantage to whiten the walls and ceiling. Staggering is simply a scheme for using some prearranged number of units to the best advantage.

Quay Lighting

Quay lighting, on the other hand, is seldom carried out on such a lavish scale as to lead to quibbles about staggering. Its main function is to outline the form of the quay to shipping, and one 40- or 60-W lamp every forty yards or so is sufficient for this. If, on the other hand, the quay is used by pedestrians after dark, much more plentiful illumination would be necessary to offset the obvious dangers.

The possible systems would seem to be a closely spaced row of low-wattage units with no special directional properties, or a more widely spaced row of special directional units, or thirdly, perhaps, an arrangement of narrow-angle floodlights mounted with large spacing and nearer ground level than usual. The special directional units in the second system would have to be such as to concentrate almost the whole available light from the lamp in two opposing directions. Something similar to prismatic bulkhead fittings might serve this purpose. The floodlighting system need not be extravagant in power consumption; it would enable most of the useful light to be directed along the quay, it would throw long and obvious shadows of obstructions, and there would be little glare in the overhead direction to add to the dangers of crane working.

Graving docks are rather a law unto themselves and it is difficult to give any guiding principles beyond the general one of plenty of light at the dangerous spots. Swing bridges and lock gates generally require a higher degree of illumination than their surroundings. Dock entrance locks, on the other hand, present a case for special treatment in the necessity for ensuring the minimum of glare to those on board ship, while amply illuminating the quays and the obstacles thereon. Fittings with a definite cut-off are demanded, unless the mounting height is so great that glare may be avoided by so keeping the light sources well out of the line of vision.

Cranes, granaries, and coal-handling plant present features of a special character. In granaries the presence of machinery and chutes upsets all attempts at a normally planned lighting system. A large number of low-wattage bare lamps, prefer-

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The Electricity Supply Outlook (*continued from opposite page*)

nection the following remarks embodied in the Board of Trade Industrial Survey of Lancashire are pertinent " . . . the need for bold selling may be greatest in rural areas . . . but at present insufficient attention is paid to selling to domestic consumers in thickly populated areas." It is safe to suggest that the rate of increase will not be lower than 18 per cent. per annum, which will give a total for 1940-41 of 8,600 million kWh, or about half the potential figure suggested above.

Probable Sales in 1940-41

The total sales in 1940-41, on a conservative basis, thus become 20,500 millions, which is very close to the estimates made by the Electricity Commission many years ago. In the meantime progress, in some respects, will be increasingly difficult; undertakings will need to use every device to attract custom, and most of all they must cut their charges to the very minimum consistent with sound management. Scales of charges must be made more flexible and adaptable so that competitive prices can be quoted for special loads, particularly off-peak loads, not requiring special capital expenditure.

Inasmuch as the running costs of supply are almost entirely incurred in generation, which will be under the continuous supervision of the Central Board, the local undertakings' main and urgent concern in the future will be to lessen the incidence of capital charges by raising load factors not only at the generating or main sub-station but also on each individual distribution line.

ably internally frosted, will generally be the best that can be achieved in the circumstances. The presence of light-coloured dust everywhere helps to minimise the glare from bare lamps. Coal-handling plant is of such dimensions as to warrant the use of floodlighting units of fairly high wattage. The use of floodlights on high standards is advisable in all cases where minerals are dealt with in bulk, or where the material handled is of considerable size or awkward shape, as in the case of steel rails and girders.

Crane lighting is a subject in which a particularly close association exists between suitability of illumination and safety. There are two opposing points of view, that of the crane driver and that of the worker below on the quay. Lights on the crane may be a source of glare to those below, while cluster and other lights on the quay may interfere with the driver's vision in that direction.

The double requirement may perhaps be met by a single system consisting of one or more very narrow angle projectors mounted on a cradle at the jib head, so as always to maintain their axes vertical. These projectors will direct a narrow beam of light vertically downward on to the load in all positions, and the sharp shadow on the ground will assist the driver to judge the height of his load from the ground. A supplementary fitting on the jib will show the driver its position. The total consumption of such a system need only be about 200 W, say 100 W in the projectors and 100 W in the supplementary fitting. This system appears to have many advantages and few drawbacks.

Some Aspects of Television Reception

FOR the resultant television image to appear positive, photographically, it is essential for the current passing through the neon tube receiver to be in phase with the impulses generated in the photo-electric cells of the transmitter. The paper, by Mr. T. H. Bridgewater, which was read before the London Students' Section of the INSTITUTION OF ELECTRICAL ENGINEERS on December 19th, indicates the importance of appreciating the significance of 180 deg. phase-changes and the numerous ways in which these can occur.

In the case of a resistance-coupled amplifier each stage produces a 180 deg. phase-change, while the type of demodulation employed also influences the phase, so that these considerations have to be borne in mind when designing suitable receiving equipment. The author shows that 180 deg. phase-changes of the carrier in high-frequency stages do not affect the resultant phase of the modulation, though smaller phase displacements of the side-bands can give rise to distortion.

Television systems generate very low and very high frequencies (compared with musical transmissions), which need to be preserved at their proper relative amplitudes during amplification, transmission, and reception. This necessitates particular care in the design of amplifiers and receivers, especially as not only must amplitudes be considered but also phase-changes must be avoided. The effects of phase distortion can be very unpleasant, particularly when the lower frequencies are concerned, owing to the difference in time of arrival of differing modulation frequencies, which results in improper positions of image components in the final impression. Loss of higher frequencies manifests itself by producing a blurred image, limiting the permissible detail.

The design of a complete radio receiver suitable for television is discussed in so far as it may differ from more customary practice. For proper preservation of the side-bands, which is essential for higher-frequency reproduction, "damped" tuning is suggested in preference to band-pass or tone-compensated circuits, the former being somewhat unwieldy on account of the wide peak separation required, and the latter introducing unwanted phase distortion. Comparison is made between various methods of detection, from the point of view both of efficiency and of quality, and practical constants are suggested.

The Automatic Regulation of Temperature

IN spite of an already wide and ever-increasing application, the vast practical edifice of automatic temperature regulation has been erected on practically negligible theoretical foundations.

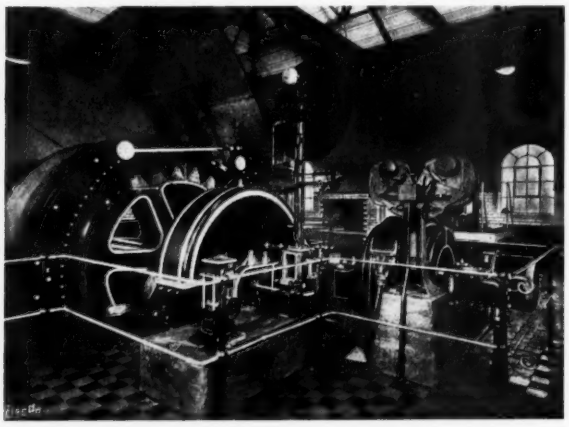
The design of controlling gear has been based almost solely on common sense, but as more came to be demanded of such gear the conclusions reached by this process have at times been contradicted by facts and apparently unreasonable phenomena have become manifest. The need for a general theory which would at least elucidate the contradictions of the expected behaviour, separate the accidental from the typical, and provide a standard by which the achievements could be judged has been felt acutely, but the complications of the subject have discouraged the search for such a general theory.

By the use of suitable thermodynamic conceptions, however, it has now been found possible, as explained in the paper by Mr. A. Ivanoff which was read before the INSTITUTE OF FUEL in London on December 13th, to reduce the character of plant to terms of non-dimensional constants, or, at the most, to simple functions, and to base on this definition a theoretical treatment which will explain the phenomena met with in practice and thus pave the way for further development of the science of temperature regulation.

Shoddy Installation Work

CHEAP electrical wiring was not necessarily shoddy, said Mr. A. H. Dykes, vice-chairman of the National Register of Electrical Installation Contractors, in a paper which he read before the ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS in London on December 19th.

What was really meant by shoddy work was the neglect of, or insufficient attention given to, minor (but important) details. The author recounted some of his early experiences of conduit wiring that could not have been described as "shoddy" and yet failed in different ways, which he detailed.



A 700-h.p. electric winder recently installed at a Yorkshire colliery **(See note on page 896)**

Mr. Dykes said that he was personally far from convinced that modern installations constituted such a danger to the public, either of shock or fire, as to warrant any further restrictions being placed on the electrical industry, and suggested that many of those who clamoured for further action were wanting in the sense of proportion.

It could not be denied, however, that there was a considerable amount of unsatisfactory work still being done, and it was incumbent upon the electrical contracting industry to do all in its power to raise the standard. The danger of poorly insulated, or worn out, flexible cord was not realised. The author was, however, personally not in favour of giving supply authorities, whether municipal or company, the right to impose wiring rules, to prescribe the type of wiring and fittings to be used, and to inspect every installation to see whether their requirements had been carried out. Their responsibility should cease at the consumers' terminals, and, as at present, they should be obliged to supply all would-be consumers provided that a test from the ends of the consumers' wiring showed that there was no leakage, and that the operation of the installation would not affect the supply to other consumers.

In his judgment, Clause 8 in the Electricity (Supply) Bill promoted by the Conference of Local Authorities, which had already passed the Lords and would come before the House of Commons early next year, should be stoutly contested. The Bill would give power to undertakers to make bylaws with respect to the nature, material, workmanship, and mode of arrangement of the wires, apparatus, and fittings in any building supplied by them, and to cut off the supply to any building in respect of which such bylaws were not complied with.

Mr. Dykes objected still more strongly to power being given to undertakers to enter any premises in which electricity was or had been supplied by them (whether for the time being occupied or not) for the purpose of ascertaining whether there had been any contravention of their bylaws and to inspect wires, fuse casings, switches, lamps and other apparatus. By accepting such clauses the electrical industry was, in effect, confessing to the public that to permit electrical wiring in houses was to accept a very great risk, and in doing so was playing into the hands of its competitors.

Registered electrical contractors were expected to follow the basic principles of the I.E.E. Wiring Regulations, and the Registration Board was convinced that its policy was the right one. Between April and September the Register's inspector had visited 219 installations, of which thirty were satisfactory in every way; in seventy-six cases contractors were warned of minor faults; in forty-nine cases more serious faults were found; in three cases there were faults for which contractors were struck off the Register; and reports were still to come in respect of the remainder. Early next year a proposal was to be made to raise the registration renewal fee to enable the expenditure on inspectors to be increased.

Naturally the first installations inspected were those where it was considered faults would be most likely, so that the results must not be taken as indicative of installation work as a whole, and it was confidently expected that in the future a much larger proportion would be found to be quite satisfactory. Mr. H. C. Hazel, the inspector of the National Register, thinks that in about 25 per cent. of the installations the wiring is in open seam, slip joint tubing with grip continuity fittings, the chief faults being want of continuity, owing largely to the enamel not being properly cleaned off the ends of the tubes and the grip continuity fittings, want of bonding strips round wooden distribution boards or wooden cased main switches, and too many wires being forced into a tube. In other cases at drop points the tubing was not brought through the plaster into the ceiling block, with the result that ends of the wires were unprotected. Probably 20 per cent. were screwed barrel installations which, being more expensive, were generally better done, the chief faults noticed being failure to bush outlets, defective earthing and running too many wires in a single tube.

The chief faults with lead-covered wiring were failure to secure continuity of the sheathing, insufficient number of clips, wires not properly anchored between the floors and over drop points, sheathing injured at junction boxes, and running it in places where the lead sheathing was likely to be eaten away by the action of plaster and moisture or gnawed by rats.

* *

Electron Tube Lamps

The subject discussed at the informal meeting of the INSTITUTION OF ELECTRICAL ENGINEERS in London on Dec. 11th was "Luminous Gas Signs," and it was introduced by Mr. Justus Eck. Lantern slides illustrated types of signs and diagrams of connections, and Mr. Eck had also arranged for an exhibition of some striking coloured tube effects and some novel devices. He expressed disapproval of the appellation "luminous gas signs" as there was a tendency for the layman to associate these signs with coal gas, and he suggested "electron tube lamps" as an alternative name. He outlined their development and challenged the statement that neon signs had made no advance in the past ten years. As evidence of progress, he said that some makers were justified in making a claim of 10,000 hours' life for well-constructed signs. The chief attractive features of the signs were the purity and variety of the colours, but lack of animation and portability were the two main disabilities. The latter points were, however, strongly challenged in the subsequent discussion. The striking effect known as the "wriggle" tube was said to be caused by so-called impurities in the gas, which enabled electrostatic charges to be formed, producing the characteristic that made the sign in some respects a notable development. It was stated that wireless interference could be eliminated by the use of suitable impedances, although any system using a vibrator or animator must inevitably cause disturbance. Flickering in the tubes was generally due to inadequate provision for overvoltage in the transformer. When newly installed, a sign might function excellently, but after a few months the neon tube "hardened" reducing the margin of striking voltage.

Cockfosters, one of the latest "Underground" stations, is well lighted. A special type of floodlight projector (described on p. 883) has been used at the depôt

Many installations were carried out with tough rubber wires threaded through holes in the floor joists.

Quite recently the author's firm had found cases in which both lead-covered wires and tough rubber wires had been damaged by rats or mice, and he, himself, would never approve of either lead-covered or any of the hard rubber or "Ite" wires being run between floors. Another trouble with all the tough rubber, and similarly insulated, wires without any metal protection was that the switches were not properly earthed. Bakelite or similarly insulated switches were used, but in many cases the insulation had chipped away and the dollies had become live. Hard metal sheathed "Stannos" wiring was not used so much as it should be, largely because if sharply bent the sheathing was broken. When properly installed it had given excellent results in places where the most expensive heavy screwed barrel would give trouble owing to condensation.

Mr. A. H. Dykes

Earthing and the risks of shock from 200 V a.c. were the chief points of anxiety at the present time and Mr. Dykes was convinced that the only really safe system was to earth the neutral wire at each consumer's premises, and use earthed concentric wiring. This system had been sanctioned by the Commissioners in a number of towns, and in nearly thirty years' experience of the results in them he had only twice had complaints of interference with the Post Office system. In each case whatever was the cause of the trouble it was not due to his multiple earthed system.

*

The Electrical Properties of Sea-water

Wireless waves travel much more easily over sea than over land and at times unusually great ranges of communication have been established with relatively low-power installations on ships. This is attributable to the much lower resistance to the passage of wireless waves which sea-water offers as compared with dry land. It is important, therefore, to have an accurate knowledge of the electrical properties of sea-water, and an investigation into this subject was described in a paper presented to the ROYAL SOCIETY by Dr. R. L. Smith-Rose, of the National Physical Laboratory, on December 14th. Experimental measurements were made at the Laboratory on samples of sea-water, taken from the English Channel, at various frequencies up to 10,000 kilocycles per second, corresponding to all wave-lengths greater than 30 metres. The general result of this work is to establish the electrical resistivity of sea-water at a value of about 20 ohms per cu. cm. For ordinary moist garden soil the resistance is nearly five hundred times as much and this accounts for the greater absorption experienced when wireless transmission takes place over land. The results of this research will find application in connection with wireless "beacons" for communication with ships at sea, and the earlier work on the electrical properties of soil is of importance in determining the best location for radio stations on land.

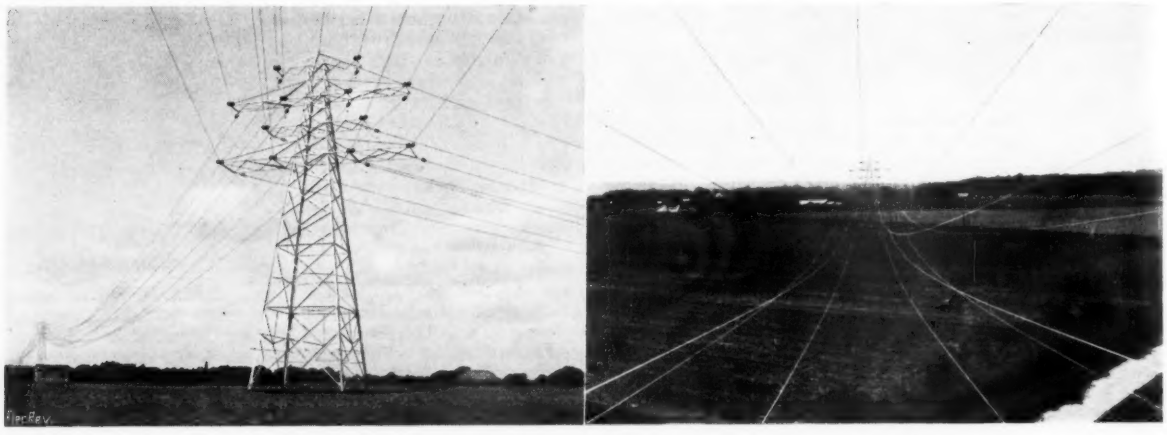
Radio Wave-length Accuracy

The importance of maintaining the accuracy of the wavelengths of wireless transmitting stations is common knowledge, and the greatest care and attention must continuously be devoted to the accuracy of measuring instruments. The standard of frequency to which all such instruments in this country are ultimately referred is at the National Physical Laboratory. The apparatus now used for this purpose was described in a paper entitled "A Valve-Maintained Tuning Fork as a Primary Standard of Frequency," which was presented to the ROYAL SOCIETY in London on December 14th. This represents the successful termination of one of the important researches on which the late Dr. D. W. Dye was engaged at the time of his death, which consisted of experiments on methods of mounting the fork and of securing exact balance of its two prongs; an investigation of the effects of slight changes of temperature and atmospheric pressure and the means of avoiding them; a study of the electrical circuit used to maintain the fork in continuous vibration, and the magnetic coupling of this circuit to the fork; and, finally, the means of determining with the highest accuracy the frequency of the fork. The complete standard equipment includes a chronograph specially designed by Dr. Dye for this purpose. Mere inspection of the chart of this instrument enables the frequency of the fork to be read with an accuracy of one part in ten millions in terms of time as measured by the standard clock of the Laboratory.

Four-circuit Grid Towers

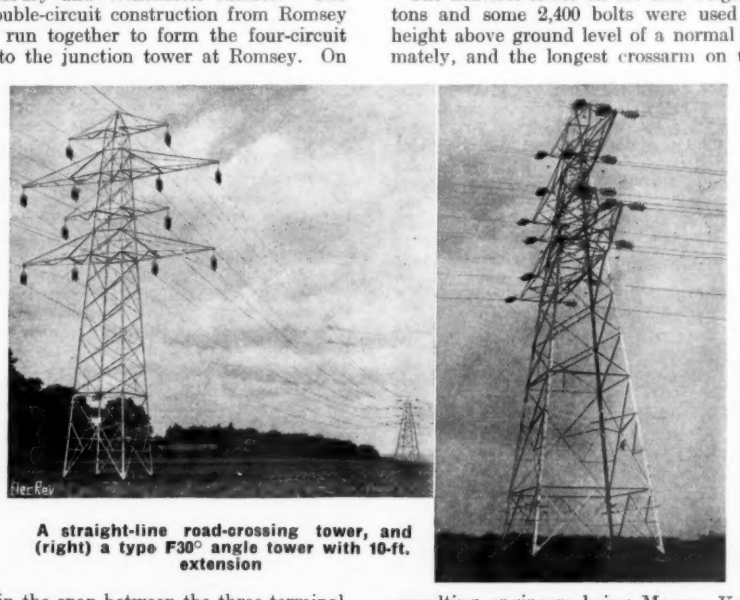
Unusually heavy loads

THE special four-circuit towers on the Nursling to Romsey power transmission line are, so far as we are aware, the first towers of their type to be erected in this country. They are part of the South-West England portion of the national grid, the Nursling sub-station being the junction point of the primary lines from Portsmouth, Southampton, and Bournemouth, and it is from this sub-station that the secondary lines to Salisbury and Winchester radiate. The last two lines are of double-circuit construction from Romsey onwards, but they are run together to form the four-circuit section from Nursling to the junction tower at Romsey. On this section of the line there are thirty-nine four-circuit towers.



Romsey four-circuit junction tower, and (right) conductors in a four-circuit line

At Nursling it would have been unsatisfactory to terminate the line on a four-circuit tower owing to the layout of the sub-station gear and the consequent difficulty of connecting the down leads. In order to overcome this trouble it was decided to terminate on two single-circuit towers and one double-circuit tower and make the first four-circuit tower (No. SE.1.) a junction tower. This method of termination, however, causes some of the conductors in the span between the three terminal towers and the junction tower No. SE.1 to cross each other. Careful thought had to be given to the cross-arm dimensions and to the locations of the towers in order to ensure that the specified conductor clearances were not infringed. Owing to the switching requirements it was not possible to eliminate the cross-overs by the rearrangement of the down lead connections.



A straight-line road-crossing tower, and (right) a type F30° angle tower with 10-ft. extension

Although the line from Nursling to the Romsey junction tower is by no means direct, it was only found necessary to use three different types of towers. For straight-line positions an F3° type was used and this type of tower is also capable of taking an angle of 3° deviation with a reduced span. For angles greater than 3° and up to 30° a type F30° tower was used and type F72° for larger angles than this and up to the maximum angle of 72° met with on the line. The latter type of tower was also erected at positions 39 and 1, *i.e.*, the two junction positions, and only very slight modifications were necessary.

Thirty-feet Extensions

To increase the height of the normal tower in order to obtain the required ground clearance over obstructions the usual 10 ft. and 20 ft. extensions were used. It was also found necessary to employ a considerable number of 30 ft. extensions on account of the undulating nature of the country traversed. The foundations on the line are, without exception, of the concrete type and special care had to be exercised in the design for the heavy angle towers. The concrete blocks for these towers measure 7 ft. square and are set at a depth of 10 ft. Special concrete floors have been made in the base of four towers.

The heaviest tower on the line weighs approximately twelve tons and some 2,400 bolts were used in its assembly. The height above ground level of a normal tower is 70 ft. approximately, and the longest crossarm on the junction tower No. SE.39 measures 46 ft. The conductor used throughout the whole scheme is 0.075 sq. in., equivalent s.c.a., and this conductor is also used for the earth wire. Since each four-circuit tower carries thirteen wires, including the earth wire, the stringing of such a line required more than usual skill, as even the smallest variation in sag between the conductors would have been noticeable on account of the number of wires.

This line formed part of Messrs. Johnson & Phillips' contract for the area, the consulting engineers being Messrs. Kennedy & Donkin, and the sub-contractors for the tower design and manufacture Messrs. Milliken Bros.

Northampton Polytechnic Prize Distribution

ONE free day per week for classes, with pay, was advocated for engineering apprentices by Mr. Handley Page in the course of a speech at the annual prize distribution and students' conversazione of the Northampton Polytechnic Institute last Friday, because, he said, practical work must be combined with theory. Specialisation, too, was another point which he strongly advocated.

A good report of the Polytechnic's work during the session was given by the Principal, Mr. S. C. Laws, who said that the full-time attendances were 5 per cent. higher this year than last, in spite of the suspension of full-time classes on Wednesday afternoons. Twenty-eight students were successful in the final examination for the B.Sc. (Engineering) degree of the University of London, first-class honours being obtained by three students and second-class honours by seventeen. In the examinations for National Certificates three higher and twelve ordinary certificates in electrical engineering were obtained. The conversazione was continued on Saturday, when a concert and play were given. The workshops and laboratories were open for inspection on both evenings.

Correspondence

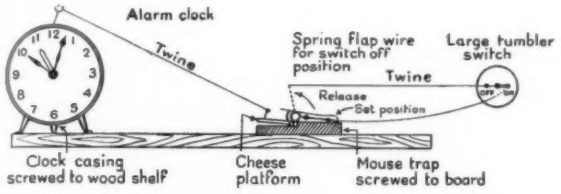
Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

An Ingenious "Time Switch"

I give below full details of a "time switch" that is used to shut down the window lighting of a large outfitter's shop in Bolton, which I have actually seen in action.

The "time switch," if I may call it such, is set each night, when the owner leaves his shop, to switch the window lighting off at 11 p.m. The total cost of constructing it was 3s. 2d., made up as follows:—An alarm clock (Marks & Spencer), 2s. 11d.; mouse trap, 3d.; a board about 1 ft. 6 in. by 4 in. by ¾ in. (from a packing case); a piece of strong twine; and some wood screws.

The board is mounted in the form of a shelf on the wall near the lighting switch. The clock is mounted on it with



the alarm bell dismantled so that the striker is open to view. The striker has a ¼-in hole drilled in the hammer part. The mouse trap is screwed down to the other end of the shelf, and a piece of string stretches from the gong of the clock to the cheese platform of the trap. The trap is set in the normal way, and the clock is set for the alarm to go off at 11 p.m. Another piece of twine is fastened from the flap wire of the trap to the lighting switch. The whole of the arrangements are shown in the accompanying sketch. The vibration of the alarm hammer is sufficient to release the trap, which in turn pulls the switch off.

W. BUCKLEY.

Blackburn, *December 14th.*

Overhead Road Crossings

Mr. Payn admits in both of his letters that the arrangement of duplicate insulators in tandem with a bridle not tied to either insulator is not satisfactory for the purpose for which it is intended, but he also says in both letters that he considers this arrangement (even without the bridle) to be strictly in accordance with the Electricity Commissioners' Regulations. That the arrangement can be said to comply with the letter of the Regulations I have not attempted to deny, but what I do contend is that no overhead line engineer worthy of the name should be content to comply with any Regulation by using an arrangement which his knowledge and experience tell him to be inadequate for its acknowledged purpose.

It is because Mr. Payn appeared in his first letter to give his blessing to those who interpret the Regulations according to the letter instead of the spirit that I characterised his attitude of mind as "lamentable"; it may be, however, that Mr. Payn would not actually allow such a construction to be adopted on his lines.

The letter from Mr. R. J. Jocelyn Swan in your issue of December 8th and that from Mr. Preston in the following issue emphasise the real reason for providing duplicate insulators and make it clear that the tandem arrangement is practically useless from this point of view (although Mr. Swan appears to contradict himself in his final paragraph). Personally, I do not favour the arrangement which Mr. Preston suggests, *i.e.*, a single, but slightly larger, insulator at road crossings with a bridle set well over the top (Mr. Preston has already shown that the bridle is not likely to be of much use if the conductor *should* burn through), but consider that the earlier arrangement of duplicate insulators side by side with a bridle attached to one insulator and the line conductor attached to the other should be provided.

I have yet to learn what real advantages are claimed for the tandem arrangement which will justify sacrificing that additional factor of safety for road crossings which the Electricity Commissioners evidently consider to be desirable. Incidentally, one wonders why the Commissioners, if they take their own Regulations seriously, approve of methods of construction which obviously do not achieve what the Regulations intend they should achieve.

ROAD USER.

December 15th.

How Demonstrators Can Help the E.I.B.A.

Miss Caroline Haslett, C.B.E., Director of the Electrical Association for Women, is kindly sponsoring a suggestion made by Miss E. Robinson of the B.E.D.A. It is suggested that all demonstrators of electrical apparatus who have access to an electric cooker should make one or more Christmas cakes to sell for the Electrical Industries Benevolent Association funds, the donation to be known as the demonstrator's contribution to our Association.

We shall be most grateful to anyone who can send us funds raised in this manner, and would like to point out to those who are able to influence the authority for which they work that such a scheme would serve as an invitation to the public to enter the local electricity showroom, and would thus tend to give publicity to electric cooking. Quite considerable sums have already been received from this scheme from demonstrators all over the country.

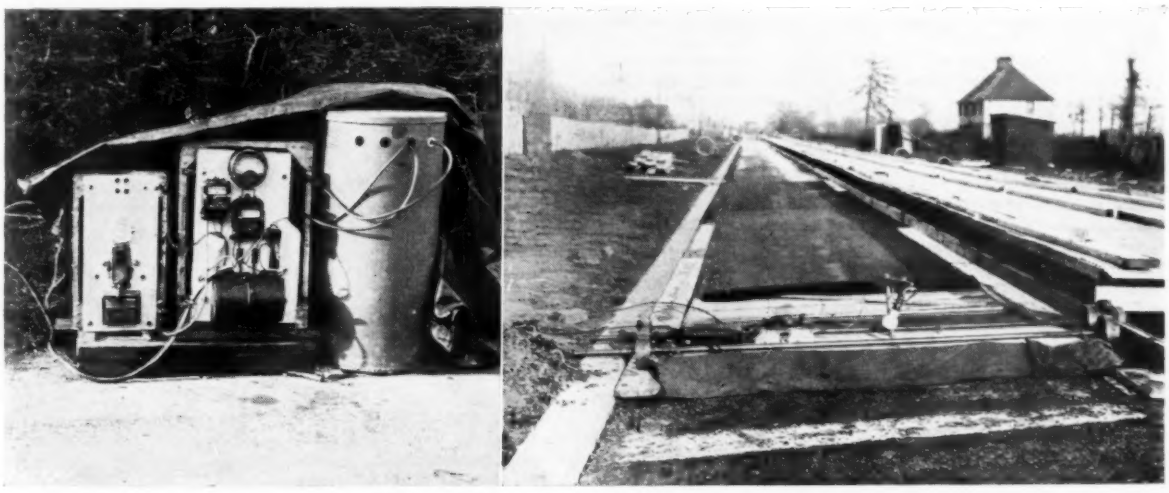
J. T. KEEPING,
General Secretary,
Electrical Industries Benevolent Association.

London, W.C.1, *December 13th.*

Electricity in Road Making

The Bucks County Council, in conjunction with the Ministry of Transport, is laying an experimental length of rubber road in this area. The foundation of the road is concrete, on which is laid two inches of coarse tar macadam, and then ¾ in. of plastic rubber, which is trowelled on by plasterers and allowed to dry. In hot summer weather the rubber hardened off in two days, when it was ready for traffic, but this experimental piece of road had its rubber put on at the end of November and it was found that the rubber would not dry off. The engineers carrying out the work then consulted us as to whether we could electrically heat the road and vulcanise the rubber surface.

A small kiosk with a single-phase 3,300-V supply was situated in the garden of a private house near the experimental



The supply arrangements and the method of employing the electrical road heater

road, but had only a 5-kW transformer inside. A 50-kW three-phase air-cooled transformer in tank was paralleled up as a single-phase unit, together with l.p. main switch, fuses, and a meter. These were erected on the road side near the aforementioned kiosk as shown in the left-hand picture and connected to the fuses controlling the 5-kW transformer suitably loaded.

A heater was made, consisting of forty spirals supported on heat-resisting insulating strips in an iron frame-work 9 ft. by 2 ft. wide, covered with an aluminium reflecting sheet; the latter had also an asbestos external cover. The frame was mounted on four 8-in. wheels so that the whole heater could be moved along the road as required. The heater was loaded to 16-kW with three switches controlling the number of spirals, but the full heat was always in use. The spirals were 4 in. from the rubber road surface.

When in use the heater, as shown in the right-hand picture, covered the full half road (9 ft.) and heated a patch 9 ft. by 2 ft., and after a period of 8 min. the heater was pushed forward 1 ft. and left for another 8 min. and again pushed on 1 ft. so that about 7 ft. length of road was heated per hour, and the rubber was by that time vulcanised and ready for rolling by a 10-ton roller. The heater was in use day and night except between the hours of 4 p.m. and 7 p.m. when no supply was given.

The supply was cut off by a Venner street lighting time switch, which at 4 p.m. closed the circuit of the tripping coils of the overhead circuit-breaker, and the breaker could not be replaced until the clock had broken contact at 7 p.m. A second heater has now been ordered and two heaters will be operated at the same time on different parts of the road.

R. J. JOCELYN SWAN,
Engineer and Manager,
Chesham Electric Light & Power Co., Ltd.

Chesham, *December 15th.*

Electrifying North Wales

Mr. W. V. Waite, in his letter on the above subject published in your issue of December 15th, states that North Wales claims to be the original home of e.h.p. power transmission. I believe I am correct in stating that the Midlands have a prior claim. In 1904-5 the sewage disposal works of this Board, covering an area of approximately 3,000 acres, were electrified by the British Thomson-Houston Co. An overhead line about 5½ miles in length operating at 2,300 V was put into commission in September, 1905. The scheme was described in your journal shortly after and I believe it was stated that this was the pioneer overhead transmission at this voltage in the country.

One of the technical journals stated that it was an experiment, which if successful would no doubt be the forerunner of many others.

M. J. PENFORD,
Electrical Engineer,
Birmingham Tame & Rea District Drainage Board.

Birmingham, *December 16th.*

Current Transformers

In reply to Mr. Ellis's query I would say that *if* there is a current in the faulty phase for the fault conditions previously supposed (fig. 1 in my letter of November 11th), it must consist of positive, negative *and* zero sequence components whatever type of transformer is considered. Mr. Ellis will not admit that a zero sequence component may be present in the secondary of a core-type transformer, but since I refuted his argument that positive and negative sequence components alone exist in the secondary for the above fault conditions he does not appear anxious to explain what currents *are* present in these windings.

As I have previously explained, a zero sequence component may exist in the secondary of a core-type transformer connected unearthed star/earthed star with a secondary circuit earth fault since the magnetic circuit is such that equal in-phase currents of quite considerable magnitude can flow in each phase of the secondary windings without producing a flux that requires compensation by similar currents in the primary. When referring Mr. Ellis to Messrs. Wagner and Evans's book I was aware that their discussion is directed to show that the zero sequence impedance of a core-type transformer differs from its positive sequence impedance, but I contend that indirectly it is also evidence in support of my analogy between the behaviour of a core-type transformer and the effect of a high impedance delta tertiary winding.

It is a well-known fact that a core-type transformer connected in the above manner is able to supply a single-phase load between one phase and neutral, and if Mr. Ellis will refer to fig. 235 (b) on page 334 of the "J. and P. Transformer Book" he will find an illustration of this form of loading with a note to the effect that it only applies to core-type transformers. Now Mr. Ellis has already agreed that no positive or negative sequence components can flow in the earth, which is equivalent to saying that they cannot exist in the neutral connection or fourth wire. He will, therefore, admit that the load current shown in the diagram as flowing in the neutral connection consists of currents of zero sequence only.

Furthermore, if the primary currents are calculated on the assumption that a zero sequence component, as well as positive and negative sequence components, is present in the loaded secondary phase winding, the figures of (total) primary current indicated will be obtained. These latter currents are made up of positive and negative sequence components only and their correctness is readily proven by equating the total power input to the transformer with the total power output.

Does Mr. Ellis still maintain that a zero sequence component cannot exist in the secondary windings of a core-type transformer with free primary neutral for a secondary circuit earth fault?

G. A. ROBERTSON.

Fallowfield, Manchester, *December 16th.*

Variations in Distribution Voltage

I was unable to attend the I.E.E. meeting at which Messrs. Kidd and Carr read their paper on "Voltage Regulation," but I have read your reports and also Mr. G. B. Gill's letter in your current issue. This really links the subject up with "Reliability of Supply," the subject of your leader in the same issue. It is not enough that the supply should be kept going; it should also be capable of giving reasonable consistency of service. The time taken to heat up my oven varies between twenty and thirty minutes; my neighbours tell me that "gas is just as bad," but surely we can score a point for electricity here with all the possibilities offered by close automatic regulation.

Incidentally the poor regulation given in some areas is unfair to manufacturers. I recently heard two consumers who live in different towns discussing the relative merits of their electric ovens. One praised the consistency with which hers produced the same results in a given time; the other was inclined to blame her cooker because it was erratic in this respect. From what I know of the two makes, there is nothing to choose between them, and I could only attribute the difference to voltage irregularities in the second case. Mr. Gill's experience that consumers complain only if the voltage is below the declared pressure agrees with my own.

Many years ago, when I used electricity for lighting only, the regulation in my district was rather wild. I put in lamps of a candle power to give enough light on Sunday evenings, but of a voltage high enough for the filaments to withstand, without too frequent renewals, the pressure rise on Wednesdays (early closing day). It cost me a few shillings more in the year for electricity and for lamps than if the supply had been constant, but this easy way out won't do now when the cooking and heating loads predominate.

December 19th. ELECTRO CONSUMER.

Contractors' Plaints

I would like your correspondent "Registered Contractor" to know that my firm is not a member of the National Register. I have had the matter under consideration for some considerable time but am still unable to see any justification for the expense incurred, assuming that our application for enrolment was accepted. There are only three contractors of any importance in the area including the supply company. The other contractor and the supply company are registered, therefore the protection we most require is against 50 per cent. of the local membership! Naturally the other contractor has been as badly hit as ourselves; he informs me that he has taken the matter up with the Register but without effect.

E. W. DEVENISH,
Berwick-on-Tweed, *Dec. 15th.* (Border Electrical Service).

A Clothes-airing Suggestion

I would like to suggest that an apparatus for airing or drying clothes would be of considerable use in the all-electric house, or for that matter in any house having an electricity supply. This should be on the principle of the small hair drier which produces a draught of hot air, but it should be on a much larger scale, designed with a 3- or 4-kW heating unit, so that it could be used from any 15-A plug.

I feel sure that there would be a considerable demand for this apparatus, which should be stoutly made. The motor, if possible, should be of the induction type and preferably should run in series with the heating element if this can be arranged. Such apparatus could be built into the base of windows or actually in cupboards and would be a great convenience for drying or airing clothes.

Possibly something of this sort is already on the market, but if not it seems to me that it would be a very good idea for manufacturers to look into the possibilities of such an apparatus, as I feel sure there would be a steady demand for it. Probably the diversity factor would be very good and it would form an attractive load to supply undertakings.

H. WILSON,
Electrical Engineer, U.D.C. Electricity Dept.

Ashford, *December 14th.*

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

New Lighting Fittings

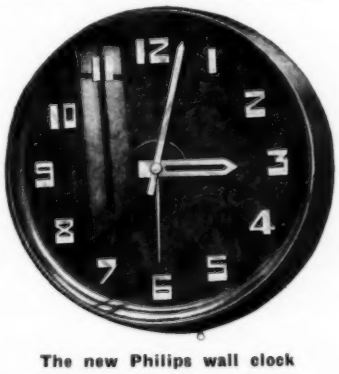
Among a comprehensive range of new lighting fittings which the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, has recently introduced are four attractive table standards which are shown in the accompanying illustration. All have a chromium-plated finish and are priced, respectively, at 25s. (F.10210), 40s. (F.10223) with an amber, pink or green sphere, 30s. (F.10209), and 27s. 6d. (F.10212), with or without figure. The same design of sphere as is used in F. 10223 is obtainable as a chromium-plated pendant for £2 10s. or as a ceiling fitting.

There are also a number of new pendants and wall bracket fittings with cylindrical glassware, besides a trough type ceiling fitting and a pendant with three small candles. For Christmas decorations there are special fittings of various shapes equipped with a number of small decorative coloured lamps. As pendants there are "Water Lily," "Dahlia" and hexagon models, while "Diamond" and "Shamrock" designs are available fitted with a stand to enable them to be used effectively on tables.

New G.E.C. table standards: F.10210, F.10223, F.10209, and F.10212

A New Wall Clock

An interesting addition to an already comprehensive range of electric clocks supplied by MESSRS. PHILIPS LAMPS, LTD., 145, Charing Cross Road, London, W.C.2, is the type 4205 wall clock. It is of distinctive design with bold figures and is particularly suited for restaurants, hotels, hospitals and other large institutions. The cases can be obtained finished in mahogany, walnut, ebony, or red "Philite"; they are handsomely moulded and measure 10¼ in. in diameter. With plated figures the price is 47s. 6d., but it is also available in a white finish with either blue or black figures at 50s.

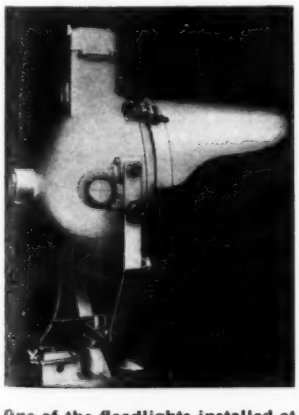


The new Philips wall clock

The simple design of the case makes fixing very easy and once in position the clock needs no further attention; it is suitable for operation on a.c. voltages from 90 to 260 V 50 cycles.

Effective Railway Lighting

The lighting of the recently opened Cockfosters Station, on the London "Underground," embodies several interesting features. The covered platforms are illuminated by means of 16-in. dia. "Superlux" spheres (made by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2) on a modern type of suspension, which permits the globe to be lowered for cleaning and lamp replacements without being detached. The open platforms are illuminated by means of half-silvered 12-in. dia. spheres.



One of the floodlights installed at the Cockfosters depôt

The special lighting installation at Cockfosters depôt centres around its floodlighting. This operates over a wide area: about fifty G.E.C. floodlights, equipped with 500-W lamps, having been installed. These floodlights have an entirely new optical jig focusing system which ensures that no light is lost through a unit being out of focus. Others installed consist of silicon-aluminium housings, and lead-backed silvered-mirror reflectors. In addition each is fitted with an improved type of positive acting device so that maintenance operations can be carried out without risk of disturbing the predetermined and accurately set adjustments. The units are totally enclosed, and having no vents the accumulation of dust or dirt on reflectors or lamps is a remote contingency. The floodlights are mounted on 35 ft. and 40 ft. concrete poles, and the illumination is powerful, evenly diffused, and free from glare.

New Radio Receivers

Three new wireless receivers have been announced by MESSRS. FERRANTI, LTD., Hollinwood, Lancs. They are the "Lancastria" radio-gramophone, the "Arcadia Magna" and the "Arcadia" radio-gramophone, priced at 26, 20 and 35 guineas respectively, the last two incorporating the "Arcadia" chassis with its magnified tuning dial in a very handsome cabinet.

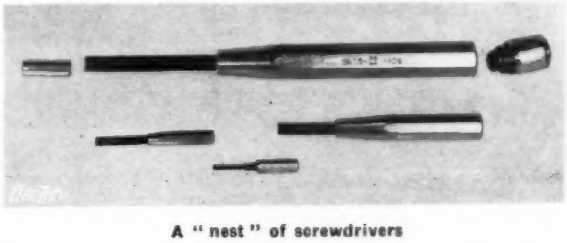
The "Arcadia" radio-gramophone

Features of the "Arcadia" receivers are the automatic volume control, "electric tuning," which gives visible indication of the best tuning position for the station being received, a manual volume control, an undistorted output of 2½ W, an incorporated "Ferranti" moving-coil loud speaker and provision for an external speaker to be connected, complete with a cut-out switch for the internal speaker and resilient chassis mounting. Single-knob tuning is used, and as regards selectivity 9 kc. separation is claimed. Gramophone pick-up terminals are also provided on the "Arcadia Magna."

A Novel Screwdriver Set

An ingenious "four-in-one" screwdriver has been sent to us for examination by MESSRS. MULLER & CO. (ENGLAND), LTD., Sphinx Works, Chase Road, Park Royal, N.W.10.

The actual length of the screwdriver, fitted with a cap to protect its ¼-in. blade, is a little under 6½ in. When the octagonal head is unscrewed another smaller screwdriver with a 4-mm. blade is revealed. Inside this fits a yet smaller one with a 3-mm. blade. A fourth, the baby of the family, is discovered by unscrewing the top of the last one; it is a minute screwdriver 1½ in. long with a blade ½ mm. wide. All the screwdrivers have octagonal brass handles and steel blades and the whole combination costs 2s.



A "nest" of screwdrivers

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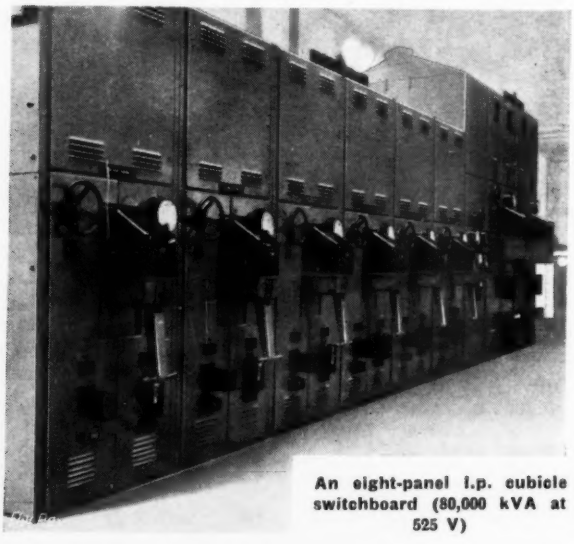
Heavy-current High Rupturing Capacity Switchgear

A Central Electricity Board contract

A LOW-VOLTAGE switchgear installation has been carried out by Messrs. Ferguson, Pailin, Ltd., to the order of the Central Electricity Board, the consulting engineers being Messrs. Kennedy & Donkin, to control the output of two 4,000-kVA transformers providing the supply from the grid to Messrs. J. & P. Coats' Anchor Mills at Paisley. The design and layout were determined by a detailed investigation and evaluation of the actual conditions which



An eight-panel l.p. cubicle switchboard (80,000 kVA at 525 V)

obtain due to the normal and maximum short-circuit currents, supplemented wherever possible by actual tests.

Although the equipment is of a somewhat special character, the complete contract was executed with the gear tested and in commission within eight weeks. The erection of the gear and the change-over of supply was carried out during the factory's summer holidays, the new supply being available when work was recommenced. On completion of this installation, a further contract was placed by the Central Board with Ferguson, Pailin, Ltd., for a similar low-voltage installation to control three 6,000-A incoming supplies from the grid to a second mill belonging to the same industrial concern. In this instance the generating plant is being retained and will be operated by the Central Board as a "selected" station.

The switchgear is of the cubicle type, with two incoming 5,000-A panels and six 2,000-A outgoing feeders to the factory. The three-phase rupturing capacity is 80,000 kVA, with a corresponding "making" current or initial value of fully asymmetrical short-circuit current of approximately 300,000 A. In the case of the type "BR.10" 5,000-A round tank circuit-breakers installed in the incoming feeder cubicles, the repulsive force on the terminals is of the order of 13,000 lb., and the downward "throw-off" force of similar character on the moving contact bars totals approximately 6,000 lb. Under these severe conditions the solenoid closing mechanism develops sufficient power to make adequate area of contact and to compress sufficiently the "kick-off" springs before the closing movement is reversed by the mechanical tripping of the breaker, thus preventing the possibility of the breaker contacts welding in.

The current rating of the breakers is proved by temperature tests over a period corresponding to the normal weekly operating conditions. The main contacts are of the full floating self-aligning pressure type fingers in conjunction with "V"-shaped moving-contact bars, all contact surfaces being silver plated. The tendency of the contact resistance to increase with time due to oxidation of the contact faces is thus minimised.

In circuit-breakers that are not frequently operated the contacts do not get cleaned by the mutual wiping action due to switching. With plain copper contacts the surface must be cleaned frequently in order to obtain satisfactory performance. The need for frequent maintenance of contacts has been eliminated by the silvering of the contact faces. Silver oxide has a conductivity equal to that of pure silver; hence no appreciable deterioration of the surface conductivity of the contacts is experienced when they are silvered.

The arcing contacts are of the rose and candlestick type of massive construction in order to deal with the extremely high value of the maximum short circuit.

The type "BR.7" 2,000-A breakers in the outgoing feeder cubicles are similar in design, all of the round tank construction, being almost entirely fabricated of welded steel. The breaker structures were subjected to routine mechanical pressure tests in the factory proving laboratory. The feeder circuit-breakers are arranged for hand closing. Circuit-breaker removal is effected by means of a special truck equipped with tank-raising and lowering mechanism.

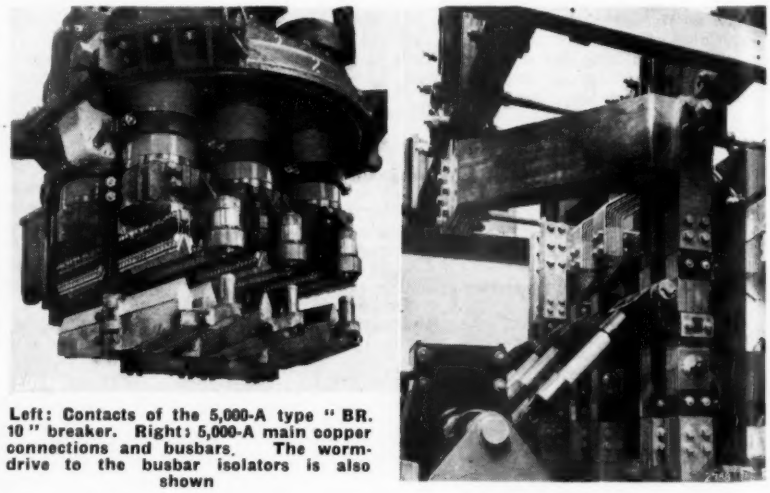
The cubicles contain 5,000-A busbars and, in the case of the incoming cubicles, 5,000-A connections. In the case of the heavy-current cubicles and busbar chambers, special provision has been made to prevent overheating and mechanical failure due to the normal current of the circuit and also to the large short-circuit current which, with an initial asymmetrical value of 300,000 A results in a repulsive force of over 2,000 lb. per foot run.

Each of the cubicles is provided with special ventilators at the top and also ventilating louvres on the front and rear doors. All inner horizontal screens are of perforated aluminium, permitting the free natural ventilation of the cubicle and also minimising local heating due to eddy currents. Portions of the cubicle structure in proximity to heavy-current conductors are constructed of non-magnetic angle steel. In this way, complete magnetic circuits round conductors are also prevented.

Strongly Braced Conductors

Class "A" current transformers for metering and also instrument and protective current transformers are accommodated in the 5,000-A incoming panels; special precautions were taken in the design to minimise the effects of interaction between transformers. All main conductors have a maximum current density of 500-A per sq. in., and are braced by bronze clamps to withstand the forces developed by the short-circuit current. This bracing is supplementary on the busbars to the insulated busbar supports, which act as supports only.

The busbar isolating switches are ganged and operated by an external hand wheel through a chain drive and worm reduction gearing. The usual mechanical indication and padlock arrangements are provided. The potential transformer is housed in a separate chamber, and its primary fuses are mounted behind a separate hinged panel, which enables the fuses to be removed and replaced safely without interfering in any way with the main equipment.



Left: Contacts of the 5,000-A type "BR. 10" breaker. Right: 5,000-A main copper connections and busbars. The worm-drive to the busbar isolators is also shown

The main connections between the transformer control cubicles and the power transformers consist of bare copper conductors run at a maximum current density of 500 A per sq. in., carried on insulated blocks from a steel supporting structure, enclosed by expanded metal screens, and braced by bronze clamps in a similar manner to the switchgear busbars. At the phase spacings adopted for the connections, the maximum force is of the order of 2,500 lb. per ft. run. In designing the bracing clamps, full account was taken of the nature of the repulsive forces and an ample factor of safety is provided.

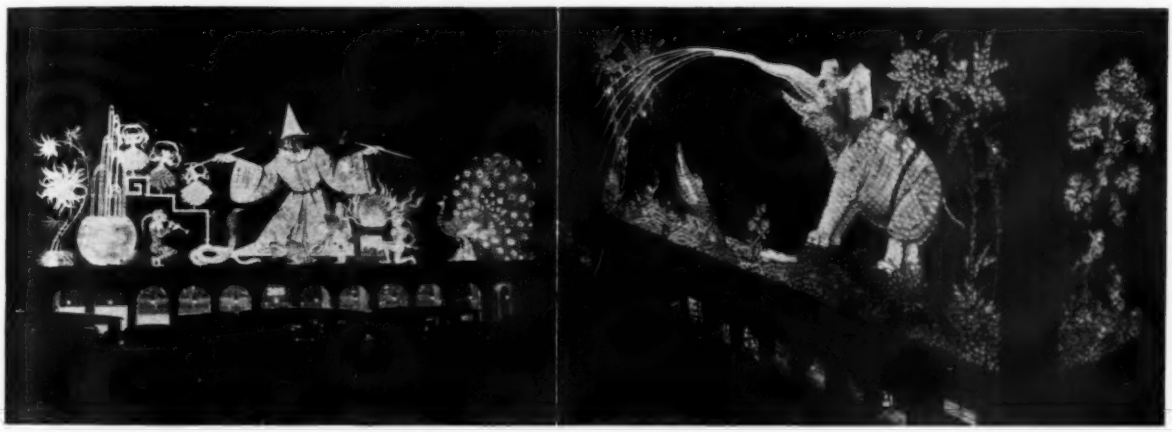
American Electrical Development

A national programme

AMERICA has before it just now a new national power policy and programme. It was laid before a lawyers' club by Mr. David E. Lilienthal, a director of the Tennessee Valley Authority, as a five-point programme for the electrification of America. His address was reprinted in the *Electrical World* for November 25th.

The President and Congress have resolved to put to work the vast sources of electricity which lie unused, and plans have been laid which place it within the power of the people to make electricity in very truth the servant of the average man and woman within the next decade. Power, next to the soil, is America's greatest resource. In many States regulation by commissions, according to Mr. Lilienthal, has proved ineffectual. The utilities have regulated the regulators instead of regulators regulating the utilities.

Therefore, to supplement regulation by commissions, Congress passed the Tennessee Valley Authority Act, which is not an assault upon private ownership and management but is a determined attack on private mismanagement of the public business of power at the expense of consumers and investors. The Act sets up public operation of the power business to serve as a "yardstick" by which to measure the fairness of electricity rates; it is a reminder that electricity performs a public service and that unless the business is conducted by private corporations with fairness, without financial jugglery and with a due sense of responsibility, the public may at any time assume the function of providing the power for itself.



Christmas lighting in two Continental capitals: Left, Paris; right, Brussels

National Electrification

One of the major objectives of the programme is a greatly increased use of electricity in the homes, the farms, and the factories of the United States—in short, an electrified America. This is the goal for which we on this side are also working, through the Central Electricity Board and the British Electrical Development Association; the points elaborated by Mr. Lilienthal may therefore be profitably studied by our own electrical men.

It is recognised that there are difficulties in the way and that the undertaking is "not going to be a Sunday School picnic." We suspect that this assertion of Mr. Lilienthal finds an echo in the heart of Sir William Ray. It seems that all over the States the use of electricity has fallen behind the installation of power-generating facilities and that unless this use can be substantially increased within the next three years the electrical industry, public and private alike, will run into a financial blind alley.

The average monthly use of electricity for domestic purposes in the States is 50 kWh per head—"parsimonious and niggardly"—but it is known from experience in some parts and in Canada that the figure can be increased several times. In Tacoma it is 104 kWh and in Ontario it has reached a figure in excess of 150 kWh.

Here, then, in brief, are the five points in the programme:—

"1. We must begin thinking in terms of an electrified America, and cast aside the tradition which is binding us to our present niggardly use of electricity. 2. Our entire electric rate structure must be re-examined and drastically revised. 3. Electric-using appliances must be put into the homes and on the farms on a scale heretofore not successfully attempted. 4. All the forces of business, scientific and engineering ingenuity and technique must be concentrated upon the problem of reducing certain of the costs of operation. 5. The people of the country must be brought to realise that there is a pool of electricity lying idle, ready and waiting to be used, and to realise what electricity can do in lightening their burdens, in increasing their incomes and making for a richer and better life."

Appliances at Reasonable Prices

In his elaboration of the programme the speaker declared that a drastic revision of rates would not result in decreased gross revenues or net incomes, if such revision was thoroughgoing and skilfully made. Reference was made to a plan for an average 2 cent per kWh rate for the fully electrified home. But low rates alone would not do the job. The people must have the appliances, devices, ranges, water heaters, refrigerators, motors and water pumps, and the existing methods for getting them must be drastically revised.

The principal item of cost in this connection had been the cost of financing and selling—in other words distribution. There must be large-scale distribution of low-cost appliances or there would never be a widespread use of electricity. This matter of electrical appliances was an integral part of the national programme. A definite plan for securing a wide distribution at low cost, of standardised high-quality electrical appliances was approaching completion with the co-operation of many interests.

In the reduction of operating and contruction costs (point 4) they would require, and would have co-operation from, many sources. Finally, the imagination of the people must be fired with the prospect of electrified homes. Farmers must be given a picture of what electricity could do to relieve farm life of many of its burdens. The whole programme was no task for a mere theorist.

> "This job is too difficult for an enthusiast who faints at the sight of a difficult business problem. This is no job for those who give up the struggle when they meet a really knotty problem. This programme for an electrified America calls for a pooling of the energies and ingenuity of the progressive leaders of the utility industry, of the electric manufacturing industry and of government. The stakes are too great for us to permit such a constructive programme to fail."

Satisfying the Consumer

Another leading authority, Mr. H. P. Liversidge, vice-president of the Philadelphia Electric Company, also delivered an important address, which is published by the same New York contemporary, on the development of a wholesale domestic electrical market. He said that market depended first of all upon creating a better feeling between the domestic customer and themselves. Unless they were able to maintain the complete confidence of the domestic customer in themselves and their conduct of the business of supplying his electricity, no sales effort would prevail however much they reduced rates through more efficient production.

The average consumer regarded his meter as a thing of mystery, he misunderstood the reading of the meter, the calculation of his bill, the relation between use and the total cost for such use. We had taken pleasure in dazzling him with our technical achievements, but we must forget technicalities and talk public benefits. We must talk about quality of service and the price paid. There must be more customer-satisfaction if there is to be increased use of electricity.

Mr. Liversidge urged companies to analyse thoroughly the

conduct of their businesses and see where they were responsible for customer-mistrust. Did the consumer feel that he was being served by a "big monopoly" and that he was helpless under the treatment of the employés of such a body? Domestic consumers must have adequate wiring installations, and a complete installation of labour-saving appliances, but they must be so thoroughly convinced of the pleasure of doing things electrically that they would not be satisfied to do them in any other manner.

Summing up, the task of developing a future wholesale business in the domestic market must be a combination of the most advanced sales knowledge and ability, with an intimate appreciation of customer psychology.

Electrical Dealer "Outcast"

As it has a bearing upon the domestic marketing question referred to above, we may fittingly allude here to the plight that has overtaken American retailers of electrical appliances through their having no national association to represent them in connection with the administration of the retail Code. The *Electrical World*, in referring to the matter, says that they have wakened to find themselves "outcasts," and as they cannot be represented on the compliance boards in the cities the electrical trade must seek expression through the departmental stores and hardware merchants who are recognised because they are organised.

It appears that electrical specialty shops in the States sell about 35 per cent. of the domestic appliances, the contractor-dealer 8 per cent., and the power company merchandising departments 20 per cent. These are not in agreement regarding policy with the department stores and hardwaremen who sell about 18 and 5 per cent. respectively. Our contemporary thinks that out of the N.R.A. compliance boards there will evolve in every city some sort of council of retail merchants which will police local trade practices in the public interest. Dealers are denied a seat because they cannot speak as a group, and the need for a national association of electrical dealers has arisen. It may be that at a meeting of the National Electrical League Council steps will be taken to deal with the matter, using membership of the local electrical leagues or associations operating in some 112 cities as a nucleus of a national association of electrical dealers.

In the Courts

LAST week Mr. Justice Branson continued the hearing of the action brought by Vulcan Foundry, Ltd., against Associated Electrical Industries, Ltd., as the successors of Metropolitan-Vickers Electrical Co., Ltd., to recover the balance of the price of the mechanical parts of thirty-one electric freight locomotives on the assumption that no price had been agreed to and that in the circumstances which had happened a reasonable price must be paid for the goods. On that head and for spares the plaintiffs claimed a total of about £51,000.

Sir Leslie Scott, K.C., continuing his closing address for the plaintiffs, said that their contract with the Metropolitan-Vickers Co. was for the construction of locomotives of G.I.P. design, and the defendants by the adoption of the Swiss design had put upon the plaintiffs a burden so much heavier as to relieve them from their obligation under the contract for a fixed price. The Metropolitan-Vickers Co. had never on any single occasion sent the Swiss company's drawings to the plaintiffs before they sent them to the consulting engineers for approval.

Sir Leslie Scott concluded his address on December 14th and his Lordship gave judgment. He said that he was not concerned with the figures in the case, having only to decide the basis on which the plaintiffs were to be paid for the mechanical parts of the locomotives.

The history of the case began in 1925 when it become known that the Indian Government was going to place an order for electric freight locomotives. The plaintiffs tendered to the Metropolitan-Vickers Co., and Metropolitan-Vickers in turn tendered to the High Commissioner for India. The prices given were for the mechanical parts of five different types of locomotives. Two types, 3 and 5, were locomotives in which the power to be supplied by the motors was to be conveyed to the driving wheels by couplings and connecting rods. With the other types this case was not concerned.

The mere acceptance of a tender did not create a binding contract. If the evolution of design resulted in something more expensive than that originally contemplated the tenderer might demand more money before he entered into a binding contract. If he demanded an increase in price the High Commissioner might refuse and in that event the tender was likely to be rejected. In bringing in the Swiss company and giving it the making of ten sets of mechanical parts there was no reason to suggest that the Metropolitan-Vickers Co. was other than loyal to the plaintiffs and wanted to give them as many locomotives as possible if not all. On June 28th, 1927, an order was given to the plaintiffs for thirty-one sets of mechanical parts. It was impossible to treat even that as constituting a binding contract.

The Swiss company had suggested alterations of design in July and on or about July 28th it was agreed that the Swiss drawings should be the basis of the locomotive to be supplied. Then followed a series of meetings at which plan by plan and price by price were discussed, and finally approved in November. There was never any concluded contract before the end of November at the earliest. If discussions had continued during all those months without any suggestion on the part of the plaintiffs that the drawings that were being evolved would involve an extra cost in manufacture, the plaintiffs might have become bound to supply at the contract price. But the fact was that from August 5th the extra cost was constantly being pointed out.

If there was no contract for a fixed price the ordinary common law practice must apply which was that the plaintiffs were entitled to a reasonable price. But "reasonable price" was not in the circumstances the proper basis of compensation to which the plaintiffs were entitled. They were, he held, entitled to the additional cost over the cost of the parts contemplated in the original tender of the plaintiffs on November 12th. That figure might not be easy to determine but perhaps the parties might find a short way of ascertaining it.

His Lordship also held that the plaintiffs would be entitled to an addition for spare parts on the same basis.

Questions as to the effect of the judgment as well as to a counterclaim by the defendants were ordered to stand over until the following day.

On December 18th his Lordship heard arguments from Sir Leslie Scott and Mr. Singleton on the form of the order to be drawn up. A long discussion took place on the question of the costs, Mr. Singleton contending that the plaintiffs were not entitled to recover the whole of the costs on the claim as the whole contest in the case was on the question of no fixed price and on that part of the case the claim was for about £51,000. That was an entirely different case from that put forward and on which the plaintiffs succeeded.

Sir Leslie Scott contended that plaintiffs should be given their costs as they had substantially succeeded in recovering a declaration for a figure on the lower basis of assessment of about £19,000.

His Lordship decided that the costs must follow the event which means that the plaintiffs recover judgment on the claim with costs.

Mr. Singleton then proceeded to open the defendants' counterclaim which arose on the maintenance clause in the contract. By the counterclaim the defendants alleged that the Vulcan Company was responsible for the design and for maintenance of the mechanical parts and were liable to indemnify the defendants in respect of two sums of £195 18s. 8d. and £1,060 4s., the cost of maintaining and replacing side bearer springs and main bearer springs which the defendants had had to pay to the Secretary of State for India on the ground that those things which the plaintiffs had designed and supplied were not satisfactory. The defendants also claimed to recover any further sums for which the defendants would become liable when the provisional sum had been finally agreed between the Secretary of State for India and the defendants.

By their defence to the counterclaim the Vulcan Co. pleaded a denial that the conditions of the contract between the Metropolitan-Vickers Co. and the High Commissioner for India and the specification formed part of the agreement for the supply by the Vulcan Co. of mechanical parts and they denied that they were responsible either for the design or the maintenance of their mechanical parts as if they were themselves the main contractors.

After the luncheon interval Sir Leslie Scott, addressing the judge, said that he and Mr. Singleton had had an opportunity during the adjournment of considering the matter of the counterclaim and they had come to the conclusion that there was something to be said on both sides and they had agreed that there should be judgment for the defendants on the counterclaim for £800 without costs and that that sum should be set off against the judgment for the plaintiffs on the claim.

Sir Leslie Scott said there was a sum of money in court and asked the consent of Mr. Singleton to its being paid out to the plaintiffs. Mr. Singleton said it might be that there would be an appeal in the case and he asked that that matter should remain in abeyance for a period with liberty to apply.

His Lordship said he thought that was reasonable. This concluded the case, which had lasted for nineteen days.

Sterling or Australian Currency?

The House of Lords, consisting of Lords Atkin, Warrington of Clyffe, Tomlin, Russell of Killowen and Wright, delivered judgment on December 15th in the appeal by the Adelaide Electric Supply Co., Ltd., from the judgment of the Court of Appeal affirming the decision of Mr. Justice Farwell in the Chancery Division granting a declaration that the plaintiffs, the Prudential Assurance Co., Ltd., as the holders of £11,000 5 per cent. "A" cumulative preference stock and £30,000 6½ per cent. cumulative preference stock of the Adelaide Co.,

and all other holders of those stocks on the English register of that company, were entitled to be paid their dividends in full in sterling and in England, and not, as the appellants contended, in Australian currency or its equivalents. The Adelaide Co. had passed a resolution to pay the dividends in Adelaide in Australian legal tender.

The appeal was unanimously allowed. Lord Atkin, in the course of his judgment, said he was inclined to think that at the present day the English pound and the Australian pound were not the same, but in the application of that view to the present case he preferred to say that at the material time the pound English and the pound Australian were the same. He thought that the law of legal tender in Australia governed the matter and that the obligations of the company were discharged by payment in Australia.

Another Currency Case

On the same day the House of Lords also considered the case of Feist *v.* the Société Intercommunale Belge d'Electricité on the appeal of the plaintiff, Mr. Josiah Feist, from the judgment of the Court of Appeal affirming the judgment of Mr. Justice Farwell in the Chancery Division. The action was a test one.

Mr. Feist was the holder of a £100 bond, part of a series issued by the respondents, a Belgian company. Each bond provided for " payment of £100 on September 1st, 1963, or such earlier day as the principal moneys thereby secured became payable under the endorsed conditions, and all interest during the continuance of the security at 5 per cent. per annum in sterling in gold coin of the United Kingdom to the standard weight and fineness existing on the first day of September, 1928." Condition 18 of the bond provided that the bond should be construed and the rights of the parties regulated according to the law of England.

Mr. Justice Farwell held that the contract was not a contract for the delivery of bullion but imposed an obligation to pay a debt with interest and that as bank notes were made legal tender by the combined effect of the Bank of England Act, 1833, and the Coinage Act, 1870, any indebtedness could be satisfied by payment in bank notes. The Court of Appeal affirmed Mr. Justice Farwell's decision, and from this result Mr. Feist now appealed.

Lord Russell of Killowen, in delivering judgment allowing the appeal, said that the difficulty in the case arose from the presence in the bond of what was sometimes known as a " gold clause " and from the particular phraseology which it had assumed. The company claimed that it was entitled to satisfy the principal moneys and interest secured by the bond by tendering whatever might be good legal tender for the nominal amount of the bond or coupon as the case might be. It was obvious that this decision would deprive of all effect the gold clause in the bond.

The bondholder (the plaintiff), on the other hand, contended that it was inserted for the specific purpose of protecting the tender against any depreciation of sterling in terms of gold. After careful consideration he came to the conclusion that they should give to the gold clause the meaning and effect for which the bondholder contended.

Having dealt with the material provisions of the Gold Standard Act, 1925, the Currency and Bank Notes Act, 1928, and with the conditions contained in the bond, his Lordship said he would allow the appeal and grant the necessary declaration.

The other members of the Court concurred, and the appeal was accordingly allowed.

The Question of a Guarantee

In the King's Bench Division on December 18th, Mr. Justice Hawke continued the hearing of an action brought by Marconiphone Co., Ltd., against Botolph Radio, Ltd., 119, Bishopsgate, E.C., and Revere Trust, Ltd., of the same address, to recover £611 6s. 9d. for valves supplied to the first defendants. The Botolph Radio Co. is in compulsory liquidation, and was not legally represented. The question for decision was whether the Revere Trust was liable for the debt due from Botolph Radio under a guarantee of an amount up to £1,000 dated in March, 1933.

Mr. J. P. Eddy, for the defendants, submitted that Mr. Westcott, the secretary of Revere Trust, Ltd., who signed the guarantee, was a mere servant of the company and was not in a position to give the guarantee. He also submitted that the guarantee was *ultra vires* the powers of the company.

Mr. R. E. Mitcheson, for the plaintiffs, submitted that the evidence disclosed that the guarantee could be held to be within the powers of the company, and it could be inferred from the evidence that the guarantee was given by the secretary with the knowledge and authorisation of the managing director.

The hearing was adjourned.

The British Industries Fair

Preliminary lists of exhibitors

THERE is every indication that next year's British Industries Fair (February 19th to March 2nd) at Castle Bromwich, Birmingham, and Olympia, London, will be as successful as its predecessors. The electrical representation at Birmingham will again be excellent, although we notice the absence of a number of prominent electrical names. The preliminary lists of electrical and allied exhibitors which we publish below contain the names of 151 concerns, 122 at Birmingham and twenty-nine at Olympia. These lists will no doubt have to be added to from time to time before the Fair opens.

The Birmingham Section

Aidas Electric, Ltd.
Allen, W. H., Sons & Co., Ltd.
Avery, W. & T., Ltd.
Ashdown (Birmingham), Ltd.
Babcock & Wilcox, Ltd.
Bakelite, Ltd.
Baldwins, Ltd.
Barton Bros., Ltd.
Becantee Illuminations, Ltd.
Belling & Co.
Beresford, Jas., & Son, Ltd.
Berry's Electric, Ltd.
Birkby's, Ltd.
Birmingham Battery & Metal Co., Ltd.
Birmingham Corporation Electric Supply Dept.
Birmingham Electric Furnaces, Ltd.
B.K.B. Electric Motors, Ltd.
Bowker, S. O., Ltd.
Bratt Colbran & Heaped Fire Co., Ltd.
Bray, Geo., & Co., Ltd.
Britannia Batteries, Ltd.
Britannia Tube Co., Ltd.
British Electrical Development Association.
British Electric Domestic Appliances, Ltd.
British Electric Welding Machines, Ltd.
British National Electrics, Ltd.
British Oxygen Co., Ltd.
British Sangamo, Ltd.
British Thomson-Houston Co., Ltd.
British Vacuum Cleaner & Engineering Co., Ltd.
Broughton, J.
Bulpitt & Sons, Ltd.
Burnley Components, Ltd.
Canning, W., & Co., Ltd.
Carron Company.
Champion Sparking Plug Co., Ltd.
Chloride Electric Storage Co., Ltd.
Clang, Ltd.
Clear Hooters, Ltd.
Commutator Grinding Block Co.
Cooke Troughton & Sims, Ltd.
Croydon Mouldrite, Ltd.
Dizer, M. C.
Donovan Electrical Co., Ltd.
Dussek Bitumen & Taroleum Co.
Earle, Bourne & Co., Ltd.
Eaves, Thomas, Ltd.
Electric Radiators, Ltd.
Electrona Electrical Products, Ltd.
Elliott, E.
Ellison Insulations, Ltd.
English Electric Co., Ltd.
Evershed & Vignoles, Ltd.
Ferguson, E. C. A.
Ferranti, Ltd.
Finney, George, & Co.
Flextol Engineering Co., Ltd.
General Electric Co., Ltd.
Gent & Co., Ltd.
Gilman, F. (B.S.T.), Ltd.
Grimston Electric Tools, Ltd.
Hague & McKenzie, Ltd.
Hawkins, L. G., & Co., Ltd.
Herbert, Alfred, & Co., Ltd.
Higgs Motors, Ltd.
Hotpoint Electric Appliance Co., Ltd.
Hufton, C. H., & Sons.
Hoover, Ltd.
Ioco Rubber & Waterproofing Co., Ltd.
Jackson Electric Stove Co., Ltd.
Johnson, Rd., & Nephew, Ltd.
Klaxon, Ltd.
Lacrinoid Products, Ltd.
Lancashire Dynamo & Crypto, Ltd.
Laurence, Scott & Electromotors, Ltd.
Lectro Linx, Ltd.
London Electric Wire Co. & Smiths, Ltd.
Lucas, Joseph, Ltd.
Martindale Electric Co., Ltd.
M. & C. Switchgear, Ltd.
Midland Metal Diecastings, Ltd.
Moffats, Ltd.
Moulded Products, Ltd.
National Time Recorder Co., Ltd.
Nobbs, Geo., Ltd.
Nuway Electrical Accessories.
Ormond Engineering Co., Ltd.
Parsons, C. H., Ltd.
P.B. Sillimanite Co., Ltd.
Pneulec, Ltd.
Pressed Steel Co., Ltd.
Rainsford & Lynes, Ltd.
Record Electric Co., Ltd.
Revo Electro Co., Ltd.
Rheostatic Co., Ltd.
Richardson, H. G., & Son, Ltd.
Rudd, E., & Co., Ltd.
Sheffield Smelting, Ltd.
Shropshire, Worcestershire, & Staffs Elect. Power Co.
Simplex Electric Co., Ltd.
Steam Gauge Mfg. Co., Ltd.
Stedman, H. G., & Co.
Steiner, I. & M.
Sturge & Baker, Ltd.
Sunbeam Vacuum Cleaner Co.
S. & W. Lighting, Ltd.
Swingler, G. & J., Ltd.
Switchgear & Cowans, Ltd.
Salora Lights.
Tangyes, Ltd.
Taylor, P. W.
Telegraph Construction & Maintenance Co., Ltd.
Tok Switches, Ltd.
Tucker, J. H., & Co., Ltd.
Vac-Tric, Ltd.
Vacuum Lamp Co., Ltd.
Walsall Conduits, Ltd.
Welbeck, Ltd.
Westinghouse Brake & Saxby Signal Co., Ltd.
Westminster Tool & Engineering Co., Ltd.
Wilkins & Mitchell, Ltd.
Wolf & Co., Ltd.

Exhibitors at Olympia

Aladdin Industries, Ltd.
Attracta Electrical Co.
Bakelite, Ltd.
Beetle Products Co., Ltd.
(Sharing with Streetly Manufacturing Co., Ltd.).
British Hanovia Quartz Lamp Co., Ltd.
British Plastic Moulding Trade Association.
Cole, E. K., Ltd.
Croydon Mouldrite, Ltd.
De la Rue, Thos., & Co., Ltd.
Ebonestos Insulators, Ltd.
Electric Art Shades (1928), Ltd.
Electro-Chemical Processes, Ltd.
General Moulding Co., Ltd.
Gillett & Johnston, Ltd.
Ideal Home Electrical Appliances, Ltd.
Imperial & International Communications, Ltd.
India Rubber, Gutta Percha & Telegraph Works Co.
Insulators, Ltd.
K.F.M. Engineering Co., Ltd.
Mayfair Shades, Ltd.
Ozonair, Ltd.
Partridge, Wilson & Co.
Radio-Aid, Ltd.
Smiths English Clocks, Ltd.
Streetly Manufacturing Co., Ltd.
Sutton, W. J.
Thermega, Ltd.
Vulcanised Fibre, Ltd.
Walker Fender Co.

Business and Industrial Notes

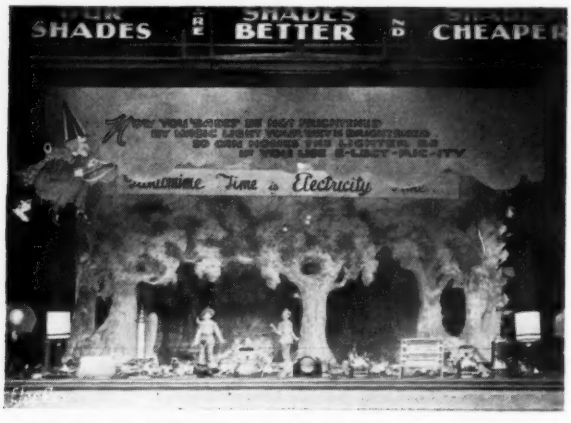
The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

Chinese Lamp Production

The manufacture of electric lamps in China by Chinese companies is of very recent growth and has not been developed except in Shanghai. Supplies of glass required in the manufacture are available from domestic sources, but metals and chemicals are mostly imported. The *Chinese Economic Bulletin* reports that there are now eleven factories in operation in Shanghai which can turn out over a million lamps per month. Previously lamps made by the China General Edison Co., in Shanghai were largely used, while Philips and Osram lamps imported from Holland and Germany respectively were also in fair demand. These makes have gradually been displaced by Chinese products. The annual consumption of lamps in China is estimated at 16,000,000, which can be met by the Chinese factories in Shanghai, whose products are also gaining popularity in the Straits Settlements, though shipments are only small at present.

E.D.A. (Northern Counties Area) Carnival

The sixth E.D.A. annual carnival will be held at the Oxford Galleries, Newcastle-upon-Tyne, on January 12th. As in previous years, many prizes are being given by electrical companies. The guests will be received by Mr. and Mrs. A. C. Cramb. Tickets (5s. each) can be obtained from Mr. A. Parkin, E.D.A. Area Officer, 47, Pilgrim Street, Newcastle-on-Tyne.



A "Babes in the Wood" scene in the window of Birmingham Corporation Electric Supply Department

Electrical Machinery Exports

The table below shows that although the actual quantity of electrical machinery exported from Great Britain during November rose by 48 tons as compared with the corresponding month of last year, the value fell by £41,871. It is satisfactory to see that Australia's share advanced, together with shipments to South America, South Africa, Japan, and "other countries." There was a very substantial fall, however, in exports to European countries, and British India's share was also much lower. The value per ton fell from £162 to £132.

Destination.	Quantities. Nov., 1932. Tons.	Nov., 1933. Tons.	Inc. or dec. Tons.	Values. Nov., 1932. £.	Nov., 1933. £.	Inc. or dec. £.
European Countries	453	155	−298	93,373	33,004	− 60,369
Japan ...	1	12	+ 11	411	1,550	+ 1,139
South America ...	52	77	+ 25	8,171	16,248	+ 8,077
South Africa ...	283	431	+148	40,928	44,056	+ 3,128
British India ...	403	366	− 37	58,304	45,935	− 12,369
Australia	57	180	+123	10,047	20,482	+ 10,435
New Zealand ...	59	32	− 27	10,115	5,103	− 5,012
Canada	79	31	− 48	7,777	4,599	− 3,178
Other Countries ...	227	378	+151	32,065	48,343	+ 16,279
Total... ...	1,614	1,662	+ 48	£261,191	£219,320	−£41,871

Details of the trade during November appear in the table at the foot of this page.

The Marking of Imported Clocks

The Board of Trade announces that a draft Order in Council was laid before Parliament on December 12th requiring certain descriptions of imported clocks, movements, escapements and synchronous electric motors to bear an indication of origin. These include the following:—Class I: Clocks "whose primary function is to indicate the time of day," including clocks mechanically driven, electrically driven (either from mains or batteries) electro-magnetically driven or electrically wound, and also boudoir and travelling clocks; upon these an indication of origin must be marked on the front or on a metal plate or label riveted thereto. Class II: Movements of clocks (*a*) with dials, durably marked in a contrasting colour on the face of the dial or on a metal plate or label riveted thereto; (*b*) without dials, die-stamped, engraved or moulded on the backplate or movement, or metal plate or label riveted thereto. Class IV: Synchronous electric motors for clocks, or movements, die-stamped, engraved or moulded on the motor or on a metal plate or riveted label. Classes III and V embrace clockwork movements and platform escapements. Under the Order, the goods specified in Classes I, II and V must bear an indication of origin on importation, or if already imported, on sale or exposure for sale; goods in the Classes III or IV must bear an indication of origin on sale or exposure for sale. Provided that the articles in Classes I, II or V were imported before the date of the coming into force of the Order or articles in Classes III or IV which were imported before the date of the Order are sold or exposed for sale before January 1st, 1935, it shall be sufficient if the indication of origin is borne on a label securely attached to each article. Goods to which the Order applies shall bear the indication of origin on exposure for sale wholesale, whether or not the person so exposing the goods is a wholesale dealer. Nothing in the Order shall apply to movements of clocks or to platform escapements which at the time of importation are parts of clocks or other articles with which they are imported. The Order will come into force at the expiration of three months from the date thereof.

German Electrical Imports and Exports

The official returns just to hand show that the imports of electrical machinery and apparatus into Germany during the nine months ended with September last attained a value of £901,650, as compared with £920,650 in the corresponding period of 1932. The exports of similar material from Germany during the nine months amounted to £8,933,500, as against £13,320,350.

British Overseas Electrical Trade in November

	Exports. Electrical exports for Nov., 1933.	Inc. or dec. as compared with Oct., 1933.	Inc. or dec. as compared with Nov., 1932.	Imports. Electrical imports for Nov., 1933.	Inc. or dec. as compared with Oct., 1933.	Inc. or dec. as compared with Nov., 1932.	Re-Exports. Electrical re-exports for Nov., 1933.	Inc. or dec. as compared with Oct., 1933.	Inc. or dec. as compared with Nov., 1932.
Insulated wires and cables ...	£103670	− £16,522	+ £5,225	£27,004	+ £4,711	− £3,280	£41	− £109	− £319
Electric carbons	7,075	+ 4,199	+ 5,625	13,513	+ 2,962	+ 3,971	—	− 17	− 95
Arc lamps and searchlights ...	107	− 152	− 398	98	+ 60	− 20	—	− 57	− 60
Incandescent lamps	39,353	+ 3,989	+ 9,456	15,411	+ 1,075	− 10,319	814	− 176	− 178
Other lighting apparatus ...	29,781	+ 2,343	+ 5,587	37,878	+ 2,863	+ 9,731	3,454	+ 1,207	+ 1,859
Batteries and accumulators ...	75,407	+ 16,765	+ 13,737	1,625	+ 74	− 4,138	188	+ 154	− 103
Meters and instruments ...	18,789	− 1,686	+ 2,119	35,515	+ 14,048	− 607	618	+ 447	+ 171
Unenumerated electrical goods and apparatus	94,287	+ 388	+ 12,273	56,695	+ 6,096	− 3,080	2,371	− 359	− 102
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cables (not submarine)	19,399	− 296	− 1,585	—	− 320	− 441	28	+ 28	+ 10
Submarine telegraph and telephone cables	5,872	− 28,290	− 40,401	—	− 9	—	—	—	—
Telegraph and telephone apparatus	271,668	+ 70,017	+ 120,714	129,372	+ 8,095	+ 16,870	1,877	+ 88	− 1,676
Electrical Machinery—									
Railway and tramway motors	9,792	+ 6,057	+ 9,488	—	—	—	—	—	—
Other motors and generators	94,735	− 8,076	− 5,256	—	—	—	—	—	—
Unenumerated electrical machinery	114,793	− 13,775	− 46,103	20,195	+ 1,196	− 8,499	1,867	− 294	− 3,454
Total	£881,728	+ £34,961	+ £90,481	£337,306	+ £40,761	+ £188	£11,258	+ £912	− £3,947
Decrease for the first eleven months of the year... ...	Exports. £180,446			Imports. £425,748			Re-Exports. £56,690		

New Coalite Works

Low Temperature Carbonisation, Ltd., has just made an issue of 3,000,000 of its 2s. ordinary shares for the purpose of putting down additional works owing to the greatly increased demand for "Coalite." It was stated at a meeting last week that the company could to-day easily dispose of the whole of the output of another works as large as those at Askern.

New "Sloan" Showrooms at Exeter

The new premises of the Sloan Electrical Co., Ltd., in Gandy Street, Exeter, were opened on December 12th, by Mr. L. G. Sloan, chairman of the company. The building, which is one of the largest in Exeter, consists of ground storerooms with an extensive floor area, and built-up high shelves capable of holding a large stock of radio sets and electrical equipment,

The showroom and stores at the new Exeter premises of the Sloan Electrical Co., Ltd.

for which the company are factors. Above are offices and staff rooms, and the demonstration and showrooms. The showrooms have unusually large windows giving a well-lighted and clear effect to the rooms, in which are displayed radio sets, radio-gramophones, lighting fittings, etc. Among those present at the opening ceremony were Mr. H. W. Denman (London manager), Mr. M. V. Eley (managing director), Mr. J. McLellan (director), and Mr. B. E. Barnes (manager of the Exeter branch).

Air Filters at the Cumberland Hotel

Referring to the article on the new Cumberland Hotel, Marble Arch, W., in our last issue, the Visco Engineering Co., Ltd., informs us that twenty-nine Visco air filters are incorporated in the air-conditioning plant supplied by the Carrier Engineering Co., Ltd. It is claimed to be the largest air filter installation in any one building.

Trade Announcements

The Electric Wiring Co., has removed to 72, Osnaburgh Street, N.W.

Bulson Bros., electrical and radio engineers, have opened new premises at Station Hill, Chippenham.

The St. Mildred's Engineering Works, Saxton Road, Westgate-on-Sea, has opened a wireless and electrical showroom in connection with its business.

Messrs. Hirst, Ibbetson & Taylor, Ltd., have opened a new depôt in Blackpool. The company's new address is 9, Blackfriars, Manchester.

The new address of Messrs. Victor H. Iddon, Ltd., is 29, Blackfriars, Manchester.

"County Company" Publicity

The County of London Electric Supply Co., Ltd., has sent us a specimen of an advertisement which it has inserted in a number of local newspapers suggesting electrical appliances as Christmas gifts. It is very effectively drawn up.

E.C.A. (Northern Branch)

The annual dinner of the Northern Branch of the Electrical Contractors' Association was held at Newcastle-on-Tyne on December 13th. Mr. A. Smith, of Bradford, who is chairman of the branch, asked for a higher standard of electrical contracting, and said that at present it seemed only necessary for a person wishing to become an electrical contractor to don overalls and get a supply from a factor. That was not good for the industry. While in certain areas there were regulations regarding electrical contracting there was no national standard, and he expressed the view that it would be better for the industry as a whole if there were. The Lord Mayor of Newcastle (Councillor J. Leadbitter) proposed the toast of the Association.

Advertisement Correction

The address of Messrs. Donald Macpherson & Co., Ltd., is Knott Mill, Manchester, and not, as stated in their last week's advertisement (Supplement, page 35), Knott Hill.

A South African Contract

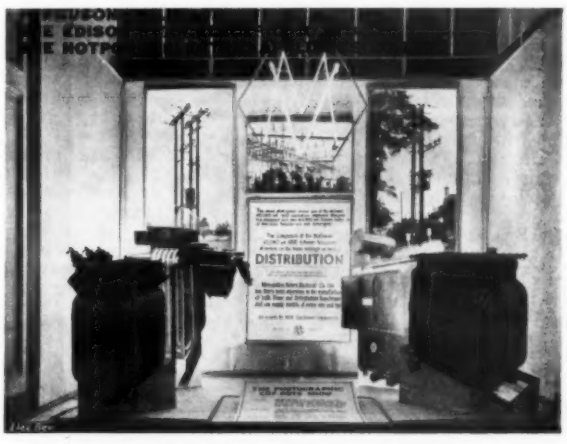
In this issue tenders are called by the City Council of Pretoria for an important extension of the municipal power station. The object of this extension is to provide for the extra power which will be required to operate the national iron and steel works which have been established at Pretoria. It is expected that these works will begin operations within the next few weeks. The Iron and Steel Corporation will supply power from its own station, but it will draw a supplementary supply from the municipal station, and this latest extension is to meet the needs of a galvanised sheet works which it has now been decided to establish in addition to the main works. The iron and steel works have been erected mainly by British contractors, and it is estimated that by the time the scheme is completed the capital expenditure will amount to £6,000,000. The intention is to manufacture 150,000 tons of steel per annum, and the attention of British manufacturers is now being directed by the Pretoria City Council to the new opportunities for private enterprise which the establishment of this key industry has opened up. The town clerk of Pretoria (Mr. M. G. Nicolson) and the city electrical engineer (Mr. L. L. Horrell), who are on a visit to this country, have been arranging the details of these power station extensions in conjunction with Messrs. Merz & McLellan, the Council's consulting engineers.

The American G.E. Sells Silk

An American exchange reports that the General Electric Co. (U.S.) is developing the general sale of a light-weight oil silk hitherto used in its insulation plants. The silk is made in Japan and specially processed; it is used for such articles as shower curtains, raincoats, umbrellas, and pyjamas.

A Novel Window Display

There is a novel window display at present on view at Crown House, Aldwych, W.C.2, in which a comparatively new technique is employed. The Metropolitan-Vickers Electrical Co., Ltd., is drawing attention to its large range of transformers for distribution work and as actual transformers, or even their tanks, are bulky things to handle in a window, these are represented by large scale photographic cut-outs, some being full size. These give a realistic appearance, and at night serve to conceal lights which play on the background. Here further photographs show the large transformers that



A Metro-Vick transformer display

have been supplied for the grid (Central Scotland Scheme) and illustrate two applications of pole-mounting transformers as used for rural distribution. On the floor a theoretical transformer diagram serves to link up the four different models.

North-West District Council Meeting

The annual meeting of the North-Western District Council for the Electricity Supply Industry took place at the Engineers' Club, Manchester, on December 12th, and in accordance with custom the employers entertained the trade unions' representatives to luncheon. The members for the new year are

as follows:—*Employers*: Aldermen E. Boothman, T. E. Higham, R. E. Roberts, W. Walker and W. Wardle, Messrs. W. Fennell, B. T. Hawkins, J. B. Hudson, H. C. Lamb, F. V. L. Mathias, P. J. Robinson, C. D. Taite and H. Wilkinson. *Trade Unions*: Councillors R. O. Jones, J. Gorman, G. Chadwick, and W. Hughes, and Messrs. F. Cookson, J. T. R. Eadington, T. Eccles, A. R. Ellis, W. H. Holding, J. H. Kearns, W. Watson, and T. Williamson. Alderman T. E. Higham, who presided, was again elected chairman; he has been the chairman or vice-chairman since the Council was established in 1919. He proposed the toast of the Trades Union members of the Council, with special reference to Councillor Gorman, chairman of the Council for the past year, and Councillor Gorman replied. Alderman Walker proposed the health of the guests, and Mr. Watkins replied. Mr. C. D. Taite, supported by Councillor R. O. Jones, moved a vote of thanks to Alderman Higham for conducting the proceedings.

Social Events

The Sports Club of Santon, Ltd., held a dance at Westgate Hotel, Newport, Mon., on December 11th, at which a large number of members and friends spent an enjoyable evening.

The Exide dance held in Birmingham on December 12th at Tony's Major Ballroom proved very successful, 450 motor and radio traders and friends being present. Dawnya and

Cabaret artistes and officials at the Exide Dance

Petrov (dancers), and the Carlyle Cousins, provided an excellent cabaret show.

A Christmassy atmosphere prevailed at the annual dinner of the staff and employés of the Aron Electricity Meter, Ltd., held at the Holborn Restaurant on December 15th, nearly 500 sitting down to real Christmas fare. Speeches were commendably brief and mostly in humorous vein. Mr. H. Kahn, chairman of the company, proposed the toast of the company, the future of which he pointed out was in the hands of the staff and employés. The health of the guests was proposed by Mr. A. White, director and manager, in a witty speech, and Mr. A. E. McKenzie, chief engineer of the Wimbledon electricity undertaking, and Mr. V. Watlington, director of B.E.A.M.A., responded in a like manner. Mr. L. Freeman, works manager, proposed the directors, and Mr. H. Morgan, in responding, said the past year's work was remarkable, and was largely due to an enthusiastic staff. The board had decided that day to pay an interim dividend. Mr. P. N. Rand, director of Electrical & Engineering Products, Ltd., paid tribute to the work of the staff and to its chief officials, and Mr. H. G. Burrows suitably responded. A pleasant evening was concluded by an entertainment given by well-known radio artistes and with dancing.

The staff of Crompton Parkinson, Ltd., and associated companies held an enjoyable smoking concert on December 15th, which was attended by over 100 members of the London office of Crompton Parkinson, Ltd., Crompton-Kye Lamp Sales, Ltd., the British Electric Transformer Co., Ltd., and Derby Cables, Ltd., including visitors from Chelmsford, Hayes and Edmonton. One of the features of the evening was community singing, some specially written songs to old tunes proving very popular.

B.T.-H. Overseas Association

A distinguished company visited Rugby on December 4th in connection with the annual dinner of the B.T.-H. Overseas Association. These included Sir Edward T. F. Crowe, Comptroller-General of the Department of Overseas Trade, Mr. G. W. Klerck, secretary to the High Commissioner for South Africa, and Mr. L. L. Horrell, of Pretoria, South Africa. In the afternoon they visited the works of the British Thomson-Houston Co., where they were received by some of the directors and senior officials of the company, and were conducted through some of the departments of the factory. A photograph taken on the occasion is reproduced on page 897. The dinner in the evening was held at the Grand Hotel, and was presided over by Mr. H. N. Sporborg, who is president of the B.T.-H. Overseas Association. The chairman sent greetings to the members overseas. The toast of "The Guests" was proposed by Mr. J. L. Wilson, and responded to by Sir Edward Crowe and Mr. G. W. Klerck. Sir Edward, in his remarks, pointed out the great service to British industry rendered by representatives of British firms resident abroad, and emphasised the necessity for the people at home to give such representatives as much assistance as possible. He also pointed out that Great Britain was now the leading export country, and saw a hopeful augury in the bookings for space in the next British Industries Fair, which he said exceeded considerably the bookings for previous years. Mr. Klerck referred to the large and increasing volume of trade between South Africa and Great Britain, and the desire of South Africa to buy in the British market. Mr. L. T. Campey proposed the toast of The British Thomson-Houston Co., and referred to the great interest which the company took in students and apprentices both from at home and abroad. Sir Felix J. C. Pole, chairman of Associated Electrical Industries, Ltd., in responding, spoke of the relations between the B.T.-H. Co. and Associated Electrical Industries, and expressed hopes for the opening of new markets in the future and an increase in the business with existing markets. The toast of the Association was proposed by Mr. R. G. Marshall, chairman of the Metropolitan-Vickers Overseas Association, who congratulated the Association on its rapid growth since its formation three years ago.

Calendars, Diaries, &c.

Christmas greetings received from the Croydon Cable Works, Ltd., take the form of wit and humour on the back of a piece of "Pernax" sheet.

The 1934 calendar of the British Thomson-Houston Co., Ltd., has monthly sheets with bold figures. The company has departed from its very familiar practice of illustrating its products, and this time employs photographic views of various historical spots within twenty miles of Rugby. The company has also prepared a very acceptable pocket diary for 1934.

The wall calendar of Messrs. Thomas R. Hills, Ltd., has weekly slips.

A view of the spires of Chartres, from a painting by Noel H. Leaver, has been selected by Messrs. Ernest F. Moy, Ltd., for their calendar, which has monthly slips.

The calendar of the West Gloucestershire Power Co., Ltd., has daily slips with quotations from Shakespeare for each day.

British Insulated Cables, Ltd., has sent us a refill for its metal-framed desk calendar. As in previous years, its wall calendar, in addition to displaying a sheet with conspicuous figures for the current month, is provided with smaller sheets showing the preceding and following months' dates, as well as those for the complete years 1932, 1933, and 1934. The company's desk pad is one of the best we have seen, and is a credit to any manager's desk.

The diary of the Stanton Ironworks Co., Ltd., is neatly bound in dark blue morocco leather and contains considerable data relating to cast-iron pipes and particulars of the company's products.

Pictures of plant supplied by the company to power stations at home and abroad head the calendar of Messrs. C. A. Parsons & Co., Ltd., which has monthly sheets.

Electrical Development at Holmfirth

The Electricity Department of the Holmfirth Urban District Council recently held a sales campaign during which there was

A part of the electrical exhibition at Holmfirth

an electrical exhibition, and two new tariffs were introduced. The new tariffs cover hired-wiring up to five lights and plug; and hired-wiring of five lights and plug, and the installation of a small cooker at an inclusive all-in charge of 2d. per kWh. The exhibition was organised by Mr. E. F. Bacon, the engineer and manager of the electricity undertaking, and was run by the staff of the Electricity Department. Lectures on cooking (with demonstrations), water heating and electricity in the home were given, and the public displayed considerable interest in the lectures and the exhibition of electrical domestic appliances. The attendance during the campaign, which lasted a week, was 3,068, and Mr. Bacon reports that the results were very gratifying. The Department intends

to run three more similar exhibitions in different parts of the area during the winter months. A section of the exhibition is shown in the illustration on the preceding page.

St. Wilfred's Church, Brighton

With reference to the electrical equipment of St. Wilfred's Church, Brighton, which was described in our issue of December 8th, page 824, we are informed that the heating apparatus was manufactured by Unity Heating, Ltd.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances :—

CHEMICALS, ETC.	Price, December 20th.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£40	—
a Ammonia, Muriate (large crystal) ... ,,	£38	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£19 15s.	—
a Potash Chlorate ... ... per lb.	3½d. to 4¼d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac T.N. ... ... per cwt.	£3	—
a Sulphur Commercial... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda Chlorate ... ... per lb.	3¼d. to 3½d.	—
a ,, Crystals... ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... per lb.	4d. less 6 per cent.	—
METALS, ETC		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil... ... ,,	1/2 to 2/9	—
p Babbits Metal and Anti friction Metals—		
Grade I ... ... per ton net	£205	£2 inc.
Grade II ... ... ,,	£141	£1 inc.
Grade III ... ... ,,	£60	—
c Brass (rolled metal 2" to 12" basis) per lb.	7d.	¼d. inc.
c ,, Tubes (solid drawn) ... ... ,,	9d. to 9¼d.	¼d. inc.
c ,, Wire, basis ... ... ,,	7¼d.	¼d. inc.
c Copper Tubes (solid drawn) ... ,,	10d.	¼d. inc.
g ,, Bars (best selected)... ... per ton	£62	£2 inc.
g ,, Sheet... ... ... ,,		
g ,, Rod ... ... ,,		—
d ,, (Electrolytic) Bars ... ... ,,	£44 10s.	£2 10s. inc.
d ,, ,, Sheets ... ,,	£64	—
d ,, ,, Wire Rods ... ,,	£44 10s.	£2 10s. inc.
d ,, ,, H.C. Wire ... per lb.	7¼d.	¼d. inc.
f Ebonite Rod ... ... ,,	1/3 to 1/6	—
f ,, Sheet ... ... ,,	1/3 to 1/6	—
n German Silver Wire ... ... ,,	2/2	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para fine ... ... ,,	4¾d.	—
i Iron, Pig (Cleveland No. 3) ... per ton	62/6	—
i ,, Wire galv. No. 1, P.O. qual. ,,	£20	—
g Lead, English Pig ... ... ,,	£12 15s.	5s. dec.
g Mercury ... ... per bot.	£9 10s. to £9 15s.	5s. dec.
e Mica (in original cases) small ... per lb.	6d. to 3/6	—
e ,, ,, medium ... ,,	4/- to 8/-	—
e ,, ,, large ... ,,	8/6 to 17/6 & up	—
p Phosphor Bronze, plain castings ... ,,	1/1	—
p ,, ,, drawn bars & rods ,,	11d.	—
p ,, ,, rolled strip & sheet ,,	11d.	—
p ,, ,, wire ... ... ,,	11¼d.	¼d. inc.
o Platinum ... ... per oz.	£7 15s.	—
d Silicium Bronze Wire ... ... per lb.	8⅛d.	⅛d. inc.
r Steel, magnet, in bars ... ... ,,	7¼d.	—
n Tin, Block (English)... ... ... pet ton	£228 10s. to £230 10s.	10s. inc.
g ,, Wire, Nos. 1 to 16 ... ... per lb.	3/5	—

Quotations supplied by :—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons
f India-Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. R. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead and rubber, up to the time of going to press, are given in our "Business Notices" under the same heading.

New Catalogues and Lists

Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.—Pamphlet No. 122, illustrating and describing network disconnecting boxes.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—Leaflet No. 292/5-1, describing the switchgear supplied by the company for the Battersea power station, and leaflet 97/2-1, entitled "Mining Switch Units, Type MU80," describing the latest form of "Metrovick" mining gate-end unit.

Sun Electrical Co., Ltd., 118 & 120, Charing Cross Road, W.C. —Three new "Sunco" catalogues dealing with (1) domestic appliances and heating, (2) electric fires, and (3) domestic appliances. The first of these combines the other two, which are being produced for those interested only in fires or domestic appliances.

Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.—Leaflet No. 1045, relating to self-acting starters (transformer type) for polyphase squirrel-cage motors.

Hardy & Padmore, Ltd., Worcester.—An illustrated catalogue of street lighting equipment, and a pamphlet drawing attention to a new design of pillar casing (No. 1567).

Belling & Lee, Ltd., Cambridge Arterial Road, Enfield.—Literature dealing with mains disturbance suppression with particular reference to the company's disturbance suppressor.

Falk Stadelmann & Co., Ltd., 83-93, Farringdon Road, E.C.—An illustrated catalogue of novel and modern table and floor standards, a leaflet illustrating decorative electric lighting bowls and shades, a priced folder showing "Efesca" electric clocks, and a leaflet relating to the company's screen-type electric fire.

Ferguson, Pailin, Ltd., Higher Openshaw, Manchester.—Publications Nos. 45A1, dealing with type GC thermal gas oil circuit-breaker operating mechanism; 33A3, types RO 32, 42, and 54, single-tank outdoor oil circuit-breakers; 56A2, type "STO" air breaker switch; and 185A1, type BR2-48/3, 66,000-V metalclad switch unit. Also booklets entitled "A Fabricating and Welding Service," and "Switchgear for Rural Electrification," the latter containing dimensioned drawings, technical data and a price list.

Holden & Brooke, Ltd., Sirius Works, Manchester.—List 945, giving brief particulars of type BZ (FCS) centrifugal pumps.

Wardle Engineering Co., Ltd., Old Trafford, Manchester.—Folder H.258, relating to "Maxheat" tubular heaters, which is available for overprinting for contractors and electrical showrooms. Also a booklet (H.257) describing the complete range of "Maxheat" tubular electric heaters.

Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, E.C.4.—Publication No. 1076, dealing with mechanical draught for boilers, furnaces, and kilns.

Ensign Lamps, Ltd., Kent Street Works, Preston.—Two showcards advertising "Ensign" lamps, and the new "Ribble" shilling lamp.

Cochranes (Middlesbrough) Foundry, Ltd., Ormesby Iron Works, Middlesbrough.—A stock list of cast-iron and spun-iron pipes.

London Aluminium Co., Ltd., Westwood Road, Witton, Birmingham.—An illustrated folder relating to "Diamond" electric hot plate aluminium cooking utensils.

A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Pamphlets Nos. 859 and 866 describing an automatic electric sequence-timing device and two-pole and three-pole contactors for d.c. or a.c.

The Northern Steel & Hardware Co., Ltd., 1-3, Southgate, Deansgate, Manchester.—Price list No. 13 of electrical and wiring sundries.

Bankruptcy Proceedings

F. W. Westover, 20, Woodbury Park Road, Tunbridge Wells, Kent, wireless dealer, late 47, St. John's Road, Tunbridge Wells.—The public examination of this debtor was held recently at the Town Hall, Tunbridge Wells. According to the statement of affairs lodged, there were liabilities of £283 and assets of £37, leaving a deficiency of £245. Debtor attributed his failure to bad trade and keen competition. The examination was adjourned for the signing of the notes.

C. E. Wooton, electrical engineer, 10, Cemmaes Terrace, Collett Road, Hemel Hempstead.—Last day for receiving proofs for dividend December 28th. Trustee, Mr. H. C. McMillan, 9-11, Cursitor Street, E.C.

C. G. Smith, electrical contractor, 66, Lichfield Street, Wolverhampton.—Last day for receiving proofs for dividend December 23rd. Trustee, Mr. A. E. Lacon, 34, Waterloo Road, Wolverhampton.

J. C. A. Willey, 12, Fernhill Road, Cowley, and 47 and 49, Cowley Road, Oxford, wireless engineer.—The receiving order herein was made on the debtor's petition. The statement of affairs filed shows gross liabilities of £1,743, of which £813 is expected to rank for dividend, and assets of £312, leaving a deficiency of £501. The position is attributed to lack of capital, lack of business experience, and general trade depression. He became aware of his position in April, 1932. Mr. E. H. Hawkins, 4, Charterhouse Square, E.C., has been appointed trustee.

A. Clough, wireless dealer, 28, Town Street, Horsforth, near Leeds.—Receiving order made December 12th on debtor's own petition.

E. C. G. Hefti, electrician, 10, Dean Road, Scarborough.—Application for discharge to be heard on February 6th at the Court House, Scarborough.

E. Blackmore, electrician, 33, Monmouth Road, Dorchester.—First and final dividend of 10½d. in the £, payable December 20th at 12, Rolleston Street, Salisbury.

D. S. B. Shannon, electrical engineer, Carlton Chambers, Lichfield Road, Mere Green.—Receiving order dated February 21st, 1933, rescinded on November 20th, debts having been paid in full.

Company Liquidations

Erith Battery Co., Ltd.—Meetings, January 15th at 1, Temple Avenue, E.C., to receive an account of the winding-up by the liquidator, Mr. L. G. Percival.

Eastern Counties Electric Equipment, Ltd.—Meetings January 15th at Balfour House, Finsbury Pavement, E.C., to receive an account of the winding-up by the liquidator, Mr. W. A. J. Osborne.

Sterling Batteries, Ltd.—Winding up voluntarily. Liquidator, Mr. P. S. Booth, 14-17, Holborn Viaduct, E.C.

Cam Electrical, Ltd., 75, Kilburn Lane, N.W.—The statutory first meetings of the creditors and shareholders under the compulsory liquidation of this company were held on December 14th at Carey Street, W.C. Mr. G. Hutcheson, Assistant Official Receiver, reported that the company was formed in August, 1931, with a capital of £2,000 to carry on business as manufacturers, repairers and retailers of all classes of goods in connection with radio-telegraphy, telephony, and television. The promoter was Charles A. McKeand, formerly a director of Rolls Caydon, Ltd. In February, 1932, the Cam Company purchased the assets and goodwill of Rolls Caydon Co. and changed its own name to Consolidated Radio Co., Ltd. A month later the company also acquired the goodwill, &c., of Rees-Mace Manufacturing Co., Ltd., for £2,100 in debentures. Later there was a serious slump in the market, and the company was in financial difficulties. Mr. A. O. Saunders Davies paid £1,000 for ten debentures of £100 each and joined the board. A new model was put on the market and a separate concern—Consolidated Radio Co., Ltd.—was formed and the name of the old company was altered back to Cam Electrical, Ltd. The company was being pressed by creditors and writs had been issued; Mr. Chas. Latham was appointed on May 4th, 1933, as receiver on behalf of the debenture holder. The accounts showed that during the whole period of the company's trading there was a gross loss of £3,499. The accounts lodged showed total liabilities of £17,345 (ranking £16,226) and assets of £1,100 absorbed in the preferential and debenture claims. The directors attributed the company's failure to (1) the excessive price paid to the receiver of Rolls Caydon, Ltd., for its sets and the subsequent chaos in that company's affairs; (2) the excessive valuations of Rees Mace Company's sets and subsequent trouble; and (3) general slump in trade. The liquidation was left in the hands of the Official Receiver.

Electricity Supply

Lighting, Domestic, Power

Ashton-under-Lyne.—REDUCED CHARGE.—The Electricity Committee has granted an application by Ashton Co-operative Society for a reduction in the charge of electricity for heating one of its establishments from 0.7d. to 0.6d. per kWh.

COUNCIL REPLACES BURNT-OUT LAMPS.—The Electricity Department is making a further concession to consumers on the assisted-wiring scheme by replacing burnt-out lamps free within the period of the agreement (ten years).

Bedford.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains at an estimated cost of £3,721.

Bexley.—NEW TARIFF.—The Urban District Council has abolished the contract rate and has adopted an all-in domestic rate, with a "unit" charge of ¾d.

Bridlington.—PROPOSED PURCHASE OF UNDERTAKING.—A special committee has been appointed by the Town Council to consider the offer by a private company to purchase the electricity undertaking at a cost not exceeding £160,000.

Burton-on-Trent.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains in Derby Street at a cost of £648.

Bury St. Edmund's.—TARIFF CHANGES.—The Town Council has decided that all licensed houses shall be eligible for a supply under the domestic tariff. For incubators and poultry appliances a supply is to be given at 1d. per kWh.

Carlisle.—EXTENSIONS.—The Electricity Committee is to lay mains to Kirkandrews, Beaumont and Burgh (£3,892), and to prepare a scheme for supply to Kirklinton and Hethersgill, at an estimated cost of £5,000. Mains are also to be extended at a cost of £1,725.

LOANS.—The electrical engineer has reported that, owing to the increasing capacity of generating plant, it will be necessary to replace switchgear in certain sub-stations at a cost of £5,200, and the Electricity Committee has decided to apply for sanction to borrow this sum.

Sanction has been obtained to a loan of £15,000 for mains and services.

Caxton and Arrington.—SUPPLY TO COUNCIL HOUSES.—The Beds, Cambs & Hunts Electricity Co., Ltd., having approached the Rural District Council for supplying electricity to Council houses at Gamlingay, the Council has decided that houses in every parish where electricity is available should be included in the proposed wiring scheme, and further information on the subject is to be obtained from the company.

ELECTRICITY SUPPLY AVAILABLE.—The Beds, Cambs & Hunts Electricity Co. has commenced a supply of electricity to Gamlingay parish, and has opened showroom premises in Church Street. Public lighting is also to be installed.

Chichester.—CANVASS.—The Electricity Committee has interviewed delegates from the Wittering, Bracklesham Bay, and District Ratepayers' Association with regard to a guarantee of £2,500 a year required for supplying electricity in the district, and has decided that the electrical engineer be asked to assist in a further canvass with a view to obtaining the required guarantee.

Clacton-on-Sea.—LOAN.—The Urban District Council has applied for sanction to a loan of £4,500 for plant and extensions to the electricity works, including £2,200 for 11-kV switchgear and £1,700 for a 500-kW rotary converter, with a 550-kVA transformer and d.c. switchgear.

Colchester.—EXTENSIONS.—The City Council has decided to carry out l.p. distribution mains extensions at Upper Brantham at a cost of £1,174, to lay a h.p. line from Little Horkesley to Wormingford at a cost of £1,460, and to supply Ramsey Lodge and South Hall, Ramsey, at a cost of £217.

BULK SUPPLY TERMS.—In connection with an application by the Frinton-on-Sea Electric Light & Power Co. for consent to install additional plant at its generating station, the Electricity Commissioners have asked whether the Corporation is in a position to afford the company a bulk supply on terms lower than those quoted in November, 1932. The Council has replied that it is unable to reduce those terms.

Croydon.—NEW COOLING TOWER.—It is announced in *The Times* that a new reinforced concrete cooling tower is to be erected at the electricity works to the designs of the Corporation's engineers, Messrs. L. G. Mouchel & Partners. The tower, together with the necessary culverts, will cost about £28,000. About 180 tons of steel reinforcing bars will be used. The new tower will be 190 ft. high and 150 ft. in diameter at the base, and capable of cooling 2,500,000 gallons of water an hour.

MAINS EXTENSION.—The Electricity Committee is to lay distributor mains in Oliver Grove and Birchanger Road at a cost of £690, and extend other mains at a cost of £1,681.

Dartmouth.—REDUCED CHARGES.—It is reported that the Urban Electric Supply Co., Ltd., has announced that the flat rate for heating and cooking is to be reduced to 1½d. per kWh as from January 1st, 1934. Previously it was 4½d. per kWh for the first 100 kWh and 3½d. thereafter. The lighting charge is also to be reduced.

Deal.—REDUCED CHARGES.—The South-East Kent Electric Power Co., Ltd., has reduced the flat rate from 8d. to 6d. per kWh to consumers at Deal, Walmer and Sandwich, and the running charge under the two-part tariff has been lowered from 1½d. to 1d. per kWh.

Denmark.—NEW POWER STATION OPENED.—The new Copenhagen power station at Oerstedsvarket, for which plant has been supplied by Messrs. C. A. Parsons & Co., Ltd., was officially opened by the Danish Prime Minister, M. Stauning, on December 15th.—*Reuter* (Copenhagen).

Ealing.—LOAN.—The Town Council is to apply for sanction to borrow £25,000, the estimated prospective expenditure in respect of l.p. mains and services during the period of three years commencing April, 1933.

SUPPLY TO FACTORY.—The Electricity Committee is in negotiation with the North Metropolitan Electric Power Supply Co. and Messrs. Allnatt, Ltd., with reference to the supply of electricity to a factory to be erected in Park Avenue.

France.—PROGRESS IN PARIS DURING 1932-33.—At the recent annual meeting of the Compagnie d'Electricité de Paris the chairman stated that the sales of power by the company during the financial year 1932-33 amounted to 534,010,512 kWh, as compared with 531,783,913 kWh in the preceding twelve months. The plant at the No. 1 power station at St. Denis has been modernised and is now working at a steam pressure of 312 lb. per sq. in. At the new St. Denis No. 2 station three sets of 40,000-50,000 kW turbo-generators are now in operation. Since October, 1932, supplies of power at 220,000 V have been drawn from the hydro-electric plant of the Société des Forces Motrices de la Truyère in Central France. The regularity with which this supply has operated has led to arrangements for further supplies at this pressure to be drawn from Eastern and South-Eastern France towards the end of 1935.

Gillingham (Kent).—SUPPLY TO LIDSING.—The Town Council is to make a canvass of the parish of Lidsing with a view to giving a supply of electricity.

Glasgow.—PROGRESS DURING OCTOBER.—Under the Corporation's wiring scheme 111 houses were dealt with in October, making the total to date 38,242, and hired appliances installed numbered 109, making the total to date 17,577.

MAINS EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £13,891.

THE CENTRAL BOARD'S PROGRAMME TESTS.—The results of tests carried out by the Central Electricity Board show that there is very little difference in performance between any of the four principal steam plants supplying the Central Scotland Area. The manager of the Corporation Electricity Department further reported that the Board's operating programme for 1934 in general allocated a production output for the principal plants as follows:—

Power Station.	Production millions of kWh.	Local use millions of kWh.	"Export" millions of kWh.
Dalmarnock	292	285	7
Portobello	280	187	93
Clyde Valley	324	265	59
Hydro power under contract ...	—	—	115

Great Yarmouth.—ELECTRICITY FOR SCHOOLS.—The Education Committee has decided to include in next year's estimates a sum of £500 for installing electricity at the Stradbroke and Cobholm groups of schools.

LOANS.—The Electricity Committee is seeking sanction to loans of £20,000 for mains and services, £5,000 for meters, £5,000 for sub-station equipment, £5,000 for domestic appliances, and £5,000 for house-wiring installations.

Haslingden.—LOAN.—The Town Council has decided to apply for sanction to borrow £2,900 for reconditioning the sub-station in Prinny Hill.

Hastings.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £590 and to replace cables (£799).

India.—CALCUTTA MUNICIPAL DEVELOPMENT SCHEME.—The Calcutta Corporation is applying to the Government for sanction for certain electrical works in respect of which exception was originally taken by the Government, which has now hinted that it may give its approval. In connection with these works the Corporation has accepted the tender of Messrs. Babcock & Wilcox, Ltd., at Rs. 76,000, for the supply and erection of two boilers and one economiser for Palmer's Bridge pumping station.

SUPPLY IN BENGAL.—The Calcutta Electric Supply Corporation, Ltd., has obtained permission from the Bengal Government to supply electricity to Baidyabati and the surrounding districts, where there are many factories and mills which still use oil as their source of power.

Irish Free State.—SHANNON SCHEME DIFFICULTIES.—It has not yet been possible to put into operation the new turbine at Ardnacrusha because of the abnormal fall in the depth of the water of the Shannon. The lack of water power has involved the Electricity Supply Board in serious difficulties, and to ensure an uninterrupted supply the Board is operating the Pigeon House station, Dublin, where additional generating plant has been installed, and the Limerick power station.

Laurencekirk.—ELECTRICITY FOR SCHOOL.—It is proposed to install electricity in the public school, and the Town Clerk is in correspondence with the Grampian Electricity Supply Co., whose representatives are to meet the Town Council regarding the laying of cables.

Lerwick.—REDUCED CHARGES.—From January 1st, the lighting rate is to be reduced from 10d. per kWh to 9d., while the power and heating flat rates are to be reduced by ½d. per kWh.

London.—ISLINGTON.—The Electricity Committee is to erect a sub-station at Brandon Road at a cost of £1,750.

FINSBURY.—The relighting of the main streets is one of the most enterprising street-lighting improvements undertaken in London during recent years. Hitherto, the lighting of the main streets of the whole of this borough has been carried out by means of some 700 lamps mounted on posts 12 to 14 ft. high. The whole of these are now being replaced by "Wembley" asymmetric lanterns equipped with "Osram" lamps. In the main streets these are of 500 W, at an average of about 120-ft. spacing, while in the secondary streets 200 W are installed at an average spacing of about 100 ft. These units are mounted on neat fluted steel columns specially made by the General Electric Co., Ltd., to the designs of Mr. A. V. Cole, A.M.I.C.E., engineer to the Borough Council. They are 25 ft. high, the lanterns being mounted at a height of 21 ft. to filament centre above road level. Each pole carries an ornamental projection arm from which the units are suspended over the roadway—the projection being 10 ft. in the case of the 500-W lanterns and 8 ft. 6 in. for the smaller units. There are in all 153 of the latter and 262 of the former. The total length of streets in which the new system is being installed is approximately ten miles. The new lighting scheme was prepared by the General Electric Co. in collaboration with the County of London Electric Supply Co., Ltd., to the requirements of Mr. Cole. The whole of the equipment, including the erection and wiring, was supplied and carried out by the G.E.C. and its sub-contractors.

A view of the new lighting in the City Road

Newcastle (Staffs).—REVISED CHARGES.—The following recommendations by the Electricity Committee for reduced charges have been approved: Flat rate of 2d. per kWh for the first 120 kWh per quarter; 1½d. above 120 per quarter; 1½d. per kWh for all energy consumed providing the minimum consumption amounted to not less than 240 kWh per quarter, or a cooker and wash-boiler, or a cooker and water-heater are installed with a change-over switch; the minimum charge to be 10s. per quarter for the two winter quarters, and 5s. per quarter for the two summer quarters. A system of discounts and rebates for prompt payment of accounts has also been instituted.

New Galloway.—SUPPLY INAUGURATED.—The electricity supply was formally switched on in the Town Hall on December 14th.

Paisley.—ALL-ELECTRIC HOUSES.—The Master of Works proposes that in part of the Corporation housing schemes all-electric houses should be erected, and details of costs, &c., are being considered.

Pewsey.—EXTENSION.—The Rural District Council has approved plans submitted by the Wessex Electric Supply Co. for the extension of the overhead lines from Pewsey to Marlborough.

Plaxtol.—SUPPLY FROM TONBRIDGE.—The Kent Power Co. having informed the Tonbridge Rural District Council that the supply cannot be extended to Plaxtol because the estimated revenue would be inadequate to justify the expenditure or the maintenance, the Council has decided to ask the Electricity Commissioners if there would be any objection to the Tonbridge Urban District Council giving a supply to the parish.

Ramsgate.—NO ELECTRICITY FOR COUNCIL HOUSES.—The Town Council has refused an application by the Ramsgate & District Electric Supply Co., Ltd., for permission to install electricity in approximately fifty Council houses, in response to applications from tenants.

St. Monance (Fife).—ELECTRICITY TO BE PROVIDED.—At the last meeting of the Town Council intimation was received from the Fife Electric Power Co. of a scheme for the installation of electricity in the burgh. The Council agreed that the scheme should be proceeded with at once.

Scotland.—PROVISIONAL ORDERS.—Among the Scottish Provisional Orders promoted during November is one by the Clyde Valley Electrical Power Co. which seeks to include in its area the parishes of Carstairs, Carnwath, Dunsyre, Dolphinton, Walston, Wiston and Roberton, Lamington and Wandel, Crawordjohn, and Crawford, in the County of Lanark, and the parish of Rosneath in the County of Dumbarton.

South Africa.—JOHANNESBURG POWER STATION.—The Tramway and Lighting Committee of the City Council proposes that the Provincial Administrator be asked to appoint a judicial committee to inquire into alleged irregularities at the municipal electric power station.

PROPOSED IMPROVEMENTS AT KRUGERSDORP.—The Town Council proposes to spend £32,000 on improving the electricity supply system. Mr. A. Q. Harvey, the municipal electrical engineer, recommends that the pressure be raised to 6,600 V, that the present sub-stations be enlarged, that five new sub-stations be built, and that the street lighting be overhauled.

Spalding.—TARIFF REVISION.—The Urban District Council has adopted the following alterations in the tariffs: "Telephone" system, the charge of 4s. per room per quarter to be abandoned, and the following substituted: A standing charge per annum equal to 12½ per cent. on the rateable value of private residences, and 20 per cent. in the rural district, subject to a minimum standing charge of £3 5s. per annum, and a maximum of £10. This system is to be extended to dwelling houses with one room converted into a shop, provided the rateable value does not exceed £15. Heating and domestic purposes, including cooking, 2d. per kWh per quarter, the quarterly consumption not exceeding 300 kWh, and 1½d. per kWh beyond, with the existing scale of discounts. As the Central Electricity Board is taking over the generating station at Peterborough from January 1st, the Council has decided to open negotiations for a revision of the charge for the bulk supply as from that date.

Stafford.—REDUCED CHARGES.—The Town Council has made reductions in the charges for electricity. The old flat rate of 7d. per kWh, less 12½ per cent., has been reduced to 6d. per kWh, less 5 per cent. The power rate for factories has been reduced, and there is a reduction to shopkeepers and business premises generally. The new standing charge for domestic use is fixed, and is generally lower than the previous rateable-value charge. The "unit" charge is ¾d., less 5 per cent.

Stockton-on-Tees.—BRICKWORKS ELECTRIFICATION.—A proposal to supply electricity to the Bowesfield brickworks is being considered by the Town Council.

NEW SUB-STATION.—Plans for a sub-station in Fairfield Road have been drawn up by the Electricity Department.

Sunderland.—MAINS EXTENSIONS.—The Electricity Committee proposes to lay cables in Holmlands Park North and Belle Vue Park.

West Lancashire.—NO SUPPLY TO BARROW NOOK.—The Rural District Council has received a letter from the Lancashire Electric Power Co. with regard to the supply of electricity in the neighbourhood of Barrow Nook. It was stated that the prospects of getting an adequate return on the expenditure involved was very remote, and the Power Company could not see its way to carrying out the extension. It pointed out that it had already expended £5,000 in Bickerstaffe, where there were only seventy-five consumers, with an approximate revenue of £200.

Whitehaven.—REDUCTION IN CHARGE.—The Town Council has reduced the charge for electricity through prepayment meters from 6d. to 5¾d. per kWh. The new tariff for a supply from the grid is £3 7s. 6d. fixed kW charge, plus a running charge of 0.2d. per kWh, as compared with the previous charge of £4 and 0.25d.

Wimborne and Cranbourne.—A SUPPLY SHORTLY.—The Wessex Electricity Supply Co. has informed the Rural District Council that, subject to wayleaves being obtained, a supply of

electricity will be available in the Verwood district in approximately six months' time.

Winchester.—ELECTRIC COOKERS.—The City Council has authorised the city electrical engineer to incur an additional expenditure of £500 on the purchase of electric cookers for hire purposes.

Wolverhampton.—PROGRESS.—The scheme for laying mains throughout the whole of the town has been completed, the last cable having been covered in by Councillor Southan, chairman of the Electricity Department. A photograph of the ceremony is reproduced on page 897. The scheme was sanctioned by the Council in March last and has involved the laying of approximately 10,000 yds. of cable at a cost of about £6,000, and there are now distributing mains in every street in Wolverhampton where there is a reasonable prospect of giving supply to prospective consumers. In the statutory area of supply there are now 434 miles of cables. Mr. T. A. G. Margary, borough electrical engineer, informs us that to date there are 30,000 consumers connected in the statutory area, and it is estimated that the number of premises in the area is 39,000. Every opportunity is taken of reducing tariffs to consumers, and the latest available figures show that Wolverhampton was 28 per cent. below the average price of the country as a whole.

MAINS EXTENSIONS.—The Electricity Committee is to extend mains to the Elston Hall Estate at an estimated cost of £704, and to lay a cable and erect a feeder pillar in Wolverhampton Road, Codsall, at an estimated cost of £603.

BULK SUPPLY.—The Committee has entered into an agreement with the Villiers Engineering Co., Ltd., for a bulk supply of electricity for a period of five years.

Worthing.—ELECTRICITY FOR SOMPTING.—Application is to be made for sanction to a loan of £8,443 to cover the cost of an extension to Sompting.

Traction

Bradford.—TROLLEY-BUS PROPOSAL.—The Corporation Tramways Works Sub-Committee, on advice from the General Manager (Mr. C. R. Tattam), recommends the substitution of trackless-buses in place of trams on the Thornton, Eccleshill and Lidget Green routes. Track renewals, which would be needed on these routes in the near future, would cost about £188,000, whereas the scheme of trackless vehicles, of which twenty-two will be required for these services, will cost only £50,000. Trackless cars are already run over these three routes to places beyond the tram termini, so the overhead equipment is there, and it is contended that there would be a saving in respect of track renewal, and a saving by avoiding running both trams and trackless over the same routes.

Darlington.—TROLLEY-BUS EXTENSION DEFERRED.—A proposal submitted by the Transport Manager to extend the trolley-bus services along Coniscliffe Road and Geneva Road West has been deferred by the Town Council.

Dover.—TROLLEY-BUSES.—Included in the Corporation's estimates in the Trolley-Bus Bill are £13,955 for electrical equipment, overhead wires, &c., and £35,200 for the provision of trolley-vehicles.

Great Yarmouth.—BUSES REPLACE TRAMS.—Buses have superseded the trams at Yarmouth, the last tram having run on Friday last.

London.—TROLLEY-BUS ROUTES.—On December 18th Sir Alfred Beit asked the Minister of Transport if he would state in which districts the proposed conversion of certain tramway routes to trolley-omnibus operation in London would involve the erection of overhead wires where at present no such wires existed. Lt.-Col. Headlam, who replied, said he was informed by the London Passenger Transport Board that its proposals for the conversion of certain tramway routes to trolley-vehicle working would involve the erection of overhead wires in the metropolitan boroughs of Holborn, St. Pancras, Islington and St. Marylebone, where such wires did not at present exist for traction purposes.

Morocco.—RAILWAY ELECTRIFICATION.—The work of electrifying the Casablanca-Marrakech railway line is now completed. Electric passenger trains will travel over the line after January 1st, and do the journey in four hours.—*Reuter's Trade Service* (Paris).

Norway.—RAILWAY ELECTRIFICATION.—The general administration of the State Railways has prepared a detailed plan for the electrification of the Ostfold line between Oslo and Kornsjo. The cost of the transformer of the western line, which deals with the foreign traffic, is estimated at 7,000,000 kr., with the addition of 3,500,000 kr. for the locomotives and other equipment.

South Shields.—TRAMWAY DEPARTMENT INQUIRY.—A committee of five members of the Town Council, which was appointed to inquire into the affairs and administration of the Tramways Department, has completed its report, which has been circulated among the councillors. The committee was appointed in June this year following allegations of maladministration in the Department's affairs.

Traffic Signals.—Automatic signals are to be placed in Central Birmingham, at the corner of Corporation Street and Bull Street. This is supplementary to the one-way traffic system which is still on trial.

Communications

Arabia.—TELEPHONY.—Telephones have just been introduced into Riyadh, the capital of Saudi-Arabia, according to the Mecca newspaper *Om El Kora*. The palace of King Ibn Saud has been linked with the central wireless station, so that the king can also communicate by telephone with various parts of his country.—*Reuter* (Cairo).

Ceylon.—COMMUNICATION SYSTEM NOT TO BE LEASED OR SOLD.—The Executive Committee of Communications and Works has finally rejected the proposal under which the island's telegraph and telephone systems would have been leased or sold outright to Imperial & International Communications, Ltd. A motion that the question be debated in the State Council was defeated. It may be recalled that Sir William Barton, representing the purchasing interests, visited Ceylon about a year ago to discuss the matter with the Government departments concerned.

Cupar (Fife).—AUTOMATIC TELEPHONY.—It has been officially intimated that the telephone system in Cupar is to be converted to automatic operation.

France.—ANTI-INTERFERENCE LAW.—The promulgation of a decree last week will compel electrical apparatus and machinery to be "anti-parasitical," which means that users of electrical equipment will have to provide means of preventing it interfering with broadcast radio reception.

Great Britain.—TELEGRAPH AND TELEPHONE PROGRESS.—For the first time in ten years there has recently been an increase in the number of telegrams handled by the Post Office. During the last few weeks telephone communication with the Continent has been greater than at any other time in the history of the service. The Postmaster-General recently stated that whereas there had been a decrease throughout the world of over two million telephones during 1932, the total in Great Britain increased, in spite of difficult times, by nearly 60,000 during 1932, and there was every likelihood that that number would be materially exceeded in 1933. In November there had been a net increase of 9,930 telephone stations, as compared with 8,844 stations in the corresponding month last year. This was the biggest number added in any month since March, 1931. In London the gross new business for November constituted a record. It was gratifying also to note that the number of cessations had been steadily decreasing throughout the country. But Great Britain was too far down the list of telephone countries, and he would not be content until this position had materially improved. In October last the number of telephones in use in this country was 2,178,815.

At the end of 1932 there were thirty-four cities in the world with upwards of 100,000 telephones, according to the *Telegraph and Telephone Journal*. Only one, the London administrative county area, is in this country. It is third on the list, with 532,743 telephones, or 11.8 per 100 inhabitants. New York is at the head, with 1,576,616 telephones, or 22.2 per 100 inhabitants; Chicago is second, with 831,679 telephones, or 23.6 per 100 inhabitants. Paris comes fourth, with 482,773 telephones, or 10.5 per 100 inhabitants, and Berlin follows, with 469,270 telephones, or 11.07 per 100 inhabitants. There are three Empire cities in the list—Toronto (fourteenth), with 193,885 telephones, or 25.6 per 100 inhabitants; Montreal (seventeenth), with 175,672, or 17.7 per 100 inhabitants; and Sydney (thirty-third), with 106,472, or 8.5 per 100 inhabitants.

During the last twenty years the number of telegrams handled annually has decreased from over 75.5 to 36 millions, whereas the number of local telephone calls has grown from 796 to 1,360.5 millions. Trunk calls have increased from nearly 38 to over 128.6 millions, and the total effective calls from 834 to 1,490 millions. The number of foreign calls increased from 112,000 in 1913 to 1,171,000 in 1933.

RADIO RELAY SERVICES.—A special committee of the Norwich Corporation has been assured that a local company will be formed, with a capital of not less than £7,000, to operate a broadcast relay service in the city. The committee recommends the Council to seal an agreement with the company to be formed by local wireless traders represented by the St. Andrew's Wireless Depôt, Ltd., for a period of ten years.

Rediffusion, Ltd., has informed the Stafford Town Council that it is not possible to conclude arrangements for the provision of a service, and the Council has agreed to the company's rights under an agreement being surrendered.

North America.—CABLE TARIFF CHANGES.—In accordance with the provisions of the International Telegraph Regulations formulated at the Madrid conference, the Commercial Cable Co., the Compagnie Française des Câbles Télégraphiques (P.Q. Co.), Imperial & International Communications, Ltd., and the Western Union Telegraph Co. announce changes in their tariffs to the United States, Canada, and Newfoundland, which will be introduced on January 1st.

Rhodesia.—TELEPHONE COMMUNICATION WITH ENGLAND.—Telephone service between London and certain parts of Northern and Southern Rhodesia, including Livingstone, Broken Hill, Salisbury, and Bulawayo, became available for public use on December 18th.

Sandgate.—SUBMARINE CABLE DAMAGED.—A submarine cable, which forms part of a telephone circuit between London and Paris, was damaged last week during a storm at sea. The cable ship *Monarch* picked up the cable and found it broken about three-quarters of a mile from the shore; repairs were carried out.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Australia.—MELBOURNE.—Post and Telegraph Department. January 2nd. Telephone switchboard lamps and sockets. (A.Y. 12053.)* Telephone jacks and number plates. (A.Y. 12066.)*

January 9th. Hand-operated telephone generators. (A.Y. 12064.)* Bells and buzzers. (A.Y. 12065.)*

January 16th. Telephone timing clocks. (A.Y. 12085.)* Telephone switchboard keys and accessories. (A.Y. 12081.)* Resistances and reactances. (A.Y. 12083.)*

January 23rd. Telephone trunk test boards. (A.Y. 12091.)*

State Electricity Commission of Victoria. January 8th. Five automatic induction voltage regulators. (A.Y. 12071.)* 115-kW a.c. motor. (A.Y. 12053.)*

January 15th. Triple-braided copper conductor. (A.Y. 12054.)*

January 30th. Telephone handsets. (A.Y. 12113.)*

BRISBANE.—January 31st. City Electric Light Co., Ltd. Land and submarine cable. (A.Y. 12072.)*

February 7th. 44-kV switchgear. (A.Y. 12092.)*

Beverley.—January 8th. Lighting installation at Walkington Mental Hospital. County architect, County Hall, Beverley (deposit £3 3s.). Tenders to Mr. G. Macdonald, clerk to the Visiting Committee, East Riding Mental Hospital, County Hall.

Carmarthen.—January 4th. Electric lighting installation at Joint Counties Mental Hospital. (December 15th.)

Cupar (FIFE).—January 6th. District Asylum Works Department. Materials for twelve months, including electric lamps and fittings. Forms from Resident Clerk of Works; tenders to Dr. W. Boyd, Medical Superintendent, Fife District Asylum.

Dunbar.—December 28th. Town Council. Various works, including electrical, at municipal cloak room and housing scheme. Specifications from Mr. W. W. Reid, architect, High Street (£1); tenders to Town Clerk.

Egypt.—ALEXANDRIA.—February 26th. Ministry of Communications. Cable, switchgear, transformers, hauling winches and motors. (A.Y. 12094.)*

CAIRO.—January 16th. Ministry of Education. Electric muffle furnace, electro-plating motor-generator, &c., for school at Giza. (A.Y. 12115.)*

India.—NEW DELHI.—Indian Stores Department. January 8th. A.c. and d.c. table fans. (A.Y. 11967.)*

Knaresborough.—December 30th. Electrical engineering work at Scotton Banks Sanatorium. West Riding Architect, County Hall, Wakefield.

London.—CENTRAL ELECTRICITY BOARD.—January 10th. 33-kV overhead transmission lines for the South-East England Electricity Scheme. (See this issue.)

COMMISSIONERS OF H.M. WORKS. January 5th. Steel conduit tubes, switches and plugs, &c., for electric wiring. (See this issue.)

ISLINGTON.—January 17th. Borough Council. Electrical and engineers' stores for one year commencing April 1st, 1934. (December 8th.)

Manchester.—January 2nd. Electricity Committee. Supply of electric breakfast cookers for twelve months. (See this issue.)

New Zealand.—WELLINGTON.—Posts and Telegraph Department. January 8th. Microtelephone cradles. (A.Y. 12046.)* Telephone jacks. (A.Y. 12045.)*

January 9th. A 100-Ah secondary battery with 60 cells. (A.Y. 12047.)*

January 16th. Thirty-five miles of v.i.r. wire. (A.Y. 12086.)*

January 17th. Forty miles of flameproof telephone jumper wire. (A.Y. 12088.)*

January 30th. 300 Planté positive battery plates. (A.Y. 12104.)* Two hot-cathode type rectifiers. (A.Y. 12106.)* Twenty 180-ohm resistance spools. (A.Y. 12105.)*

January 31st. One stationary battery of twelve unburnt cells. (A.Y. 12107.)*

February 5th. Seventy-five tons of hard-drawn copper wire. (G.Y. 13208.)*

February 6th. 71,000 dry cells for telephone use. (A.Y. 12101.)*

February 13th. Twenty-four 0-8430 ohm rheostats. (A.Y. 12103.)* Fifty miles of tinned copper v.i.r. wire. (A.Y. 12108.)*

January 16th. Public Works Department. Four 1,500-kVA transformers. (A.Y. 12017.)*

January 31st. Government Stores Control Board. Electric lamps for one year. (A.Y. 12128.)*

CHRISTCHURCH.—January 11th. City Council. Single-phase and three-phase power transformers. (A.Y. 12089.)*

Penicuik.—December 30th. Town Council. Various works, including electric lighting, at Edinburgh Road housing scheme. Specifications, &c., from Messrs. Morham & Brotchie, surveyors, 29, Hanover Street, Edinburgh; tenders to Town Clerk.

Persia.—TEHERAN.—January 7th. Municipal Council. Boilers, turbo-alternator sets, switchboards, transformers and cables, in connection with a proposed power station. (A.Y. 12079.)*

Runwell (Essex).—February 28th. East Ham and Southend-on-Sea Joint Visiting Committee. Electrical installation at Mental Hospital. (See this issue.)

South Africa.—PRETORIA.—March 2nd. City Council. Turbo-alternator, condensing plant and auxiliaries, boilers and electrically operated crane. (See this issue.)

BULAWAYO.—February 1st. Municipality. One 4,000-kW turbo-alternator, switchgear, and transformers. (A.Y. 12122.)*

GWELO.—February 6th. Municipality. Equipment for extensions to electricity undertaking comprising two 1,000-kW turbo-alternators, pumps, crane, switchgear, transformers, &c. (A.Y. 12124.)*

JOHANNESBURG.—January 15th. Railways and Harbours. Train lamps and fittings. (G.Y. 13168.)*

Southend-on-Sea.—December 28th. Electricity Department. Transformer kiosks. (December 8th.)

Tottenham.—January 16th. U.D.C. Renewal of electrical installation in the Town Hall and Central Baths. (December 15th.)

Uruguay.—MONTEVIDEO.—January 8th. State Electricity Supply and Telephones Administration. Two automatic telephone exchanges and a "complaints" indicator desk. (A.Y. 12118.)*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Barrow-in-Furness.—Electricity Committee. Accepted. Two 10-kVA and two 25-kVA transformers (£138).—Yorkshire Electric Transformer Co., Ltd. Protective gear (£114).—Metropolitan-Vickers Electrical Co., Ltd. Switchgear (£368).—Johnson & Phillips, Ltd. Twelve disconnecting boxes (£76).—W. T. Henley's Telegraph Works Co., Ltd.

Boston.—Town Council. Accepted. Installation of electric lighting in the west side of the municipal buildings (£154).—C. F. Parkinson.

Burton-on-Trent.—Electricity Committee. Accepted. Switchgear (£560) and two 500-kVA transformers (£470).—Metropolitan-Vickers Electrical Co., Ltd.

Golborne.—Urban District Council. Accepted. Electrification of dredgers at the sewage disposal works (£100).—W. E. Farrar, Ltd.

Glasgow.—Police Committee. Accepted. Electrical installation at Central Police Office garage (£84).—A. Anderson, Ltd.

Streets Committee. Accepted. Electromatic vehicle-operated traffic signals (£2,816).—Automatic Electric Co., Ltd.

Transport Committee. Accepted. Lead-covered cable.—Metropolitan Electric Cable & Construction Co., Ltd.

Kettering.—Electricity Committee. Accepted. Metering equipment (£297).—Ferranti, Ltd., in lieu of previous tender.

Lanchester (DURHAM).—Rural District Council. Accepted. Supply and erection of overhead conductors, poles and brackets for the street lighting at Burnhope.—F. Reid, Ferens & Co.

Lichfield.—City Council. Accepted. Switchgear for the extension to Streethay (£277).—Crompton Parkinson, Ltd. Wiring eighteen houses at Leafields (£75).—Richards & Co.

London.—WESTMINSTER.—Highways Committee. Recommended. Traffic signals in Regent Street (£2,740).—Automatic Electric Co., Ltd.

ISLINGTON.—Electricity Committee. Transformers. (Extension of contract for two years.)—Hackbridge Electric Construction Co., Ltd. Extension of mains.—G. Wimpey & Co., Ltd.

STEPNEY.—Electricity Supply Committee. Recommended. Twelve months' supply of cable and flexible (£1,344).—W. Geipel, Ltd.

WANDSWORTH.—Highways Committee. Recommended. Traffic signals in Trinity Road (£370).—Automatic Electric Co., Ltd.

FULHAM.—Electricity Committee. Accepted. 900 prepayment meters.—Measurement, Ltd.: R. Hornby & Co., Ltd. 300 quarterly meters.—Measurement, Ltd.; Aron Electricity Meter, Ltd. Switchgear for Dawe Road sub-station (£189).—Crompton Parkinson, Ltd.

Recommended. Installation of neon lighting at Public Baths (£157).—Electrolumination, Ltd.

Norwich.—Watch Committee. Recommended. Traffic signals (£238).—Laurence, Scott & Electromotors, Ltd.

Portsmouth.—Contracts Committee. Accepted. E.h.p. cable (£416).—Edison Swan Cables, Ltd.

Tramways Committee. Recommended. Overhead equipment for railless trolley vehicles (£3,997).—Clough Smith & Co., Ltd.

Surbiton.—Metropolitan Water Board. Accepted. Electric lathe (£255).—Denhams Engineering Co., Ltd. Electric shaping machine (£154).—C. M. Hill & Co.

Swansea.—Electricity Committee. Accepted. Steam pipes, &c., for power station (£37,746).—Aiton & Co., Ltd.

Tynemouth.—Electricity Committee. Accepted. 250-kVA transformer (£159).—Bruce Peebles & Co., Ltd.

Housing Committee. Accepted. Wiring ninety-six self-contained houses on Ridges Estate (£444).—J. Mayo & Co.

Weymouth.—Town Council. Accepted. H.p. cable (£1,342).—Johnson & Phillips, Ltd.

Diesel-electric Ships in France

Four new Diesel-electric twin-screw steamers have lately been added to the fleet of vessels employed by the Lights and Buoys Department of the French Ministry of Public Works in maintaining the lighthouses and buoys round the French coast. A feature of the new vessels, which have a length of 154 ft. and a tonnage of about 750 tons, is that they are each fitted with two Diesel six-cylinder four-stroke engines developing 500 h.p. at 300 r.p.m. coupled direct to Alsthom 330-350-kW 500-515-V generators, and an auxiliary 70/75-kW, 230-V dynamo. Each of the main machines supplies energy to a separate 410/450-h.p. motor for the driving of one of the two propellers.

Notes

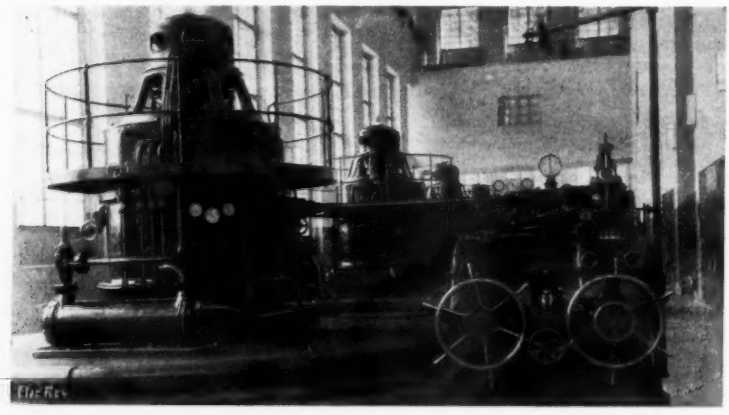
Coal-mine Electrification

Messrs. Fountain & Burnley, Ltd., of Barnsley, decided some months ago to dispense with the main steam winder at their North Gawber Colliery and install an electric winder to deal with the growing output of the colliery. The change-over from the old method of steam winding has just taken place. The new equipment consists of an induction motor having an r.m.s. rating of 700 h.p. coupled through gearing to a bi-cylindro-conical drum varying from 9 ft. 6 in. to 13 ft. diameter. An automatic electrical equipment controls acceleration and deceleration of winding and is so designed that in the event of the winding engineman being unable to operate the controls for any reason automatic braking is applied, and the winder comes to rest without the risk of over winding. The picture on page 878 shows the general layout of the new winder, which will pull 15,000 tons of coal per week and is capable of 74 winds per hour with a net load of over 3 tons per wind, from a depth of 420 yards. This output is with two-deck cages and simultaneous decking. Temporarily, however, the old single-decking cages are being used and under these conditions 100 winds per hour are being obtained from a depth of 230 yards.

This equipment is the third installed by Messrs. Fountain and Burnley during the last few years. The others are in operation at one of their adjoining collieries which is now completely electrified. The electrical installation at these collieries, which has been carried out by the Yorkshire Electric Power Co., and of which the new winder forms a part, includes a ventilating fan of 150 h.p., screens 80 h.p., washery 150 h.p., and several small surface drives of about 100 h.p. Underground, the application of machine mining has been adopted and approximately 450 h.p. is in use for coal cutters and conveyors, together with about 300 h.p. for haulage and pumping purposes, so that the recent change-over at North Gawber Collieries has involved the installation of about 2,000 h.p. of electric motors.

Hydro-electric Power in the Desert

The discovery of the great Qattara depression in the northern part of the Libyan Desert prompted Dr. John Ball to suggest that this natural hollow might be utilised for generating hydro-electric power by admitting sea water into it with a considerable fall from the Mediterranean, the influx being continuously disposed of by evaporation from the surface of the salt lake which would thus be formed within the depression.



The Handeck hydro-electric station

Since 1927 the entire area has been contour-mapped in detail by the Survey Department of the Egyptian Government, systematic evaporation observations have been taken, and borings have been made to ascertain the underground structure of the area and this recently acquired data enables Dr. Ball to give more precise particulars of the scheme. In the journal of the Royal Geographical Society he estimates that the potential power available is 330,000, 328,000, and 240,000 kW, with lakes 50, 60, and 70 metres below sea level respectively. Taking various losses into account, the net outputs would be roughly 60 per cent. of these figures. The sea water would be conveyed partly through tunnels and partly by open canal, the power transmission being 250 km.

Whether the scheme can be recommended on economic grounds must depend on the prospective future demand for electricity in Lower Egypt, and on the cost of producing power in this way as compared with either generating it at the newly heightened River Nile dam at Aswan and transmitting it over 900 km. (560 miles) to the delta, or erecting fuel-consuming stations nearer to the sites of its application.

An E.P.E.A. Dinner

The Lord Mayor of Cardiff (Alderman A. E. Gough), who is chairman of the City Electricity Committee, was one of the chief guests at the annual dinner of the South Wales Section of the Electrical Power Engineers' Association held at Cardiff on December 16th. Mr. J. E. Foster, A.M.I.E.E., presided. Proposing the toast of "The Electricity Supply Industry," the Lord Mayor said that the electrical industry was almost the only industry which was forging ahead. Cardiff was doing remarkably well so far as electricity was concerned. Mr. J. W. Beauchamp, manager of the South-West England and South Wales Area for the Central Electricity Board, responding, said that electricity was playing a big part in social betterment. He saw no reason why South Wales, with the best coal in the world and surrounded by water, should not export large quantities of electricity across the border.

Mr. A. Nichols Moore, borough electrical engineer, Newport, proposed "The Association." The industry, he said, was facing the serious position of finding room for those who would be forced out by the national scheme. Engineers should turn their attention to the sales side of the industry, and fit themselves to fill the positions which would become available. Mr. D. J. Duffy, president of the Association, responding, said that while the Association was willing to take into its ranks sales engineers it was not prepared to alter its rules, which made it a condition of admission that a man must be a competent engineer. Mr. Edward Jones, A.M.I.E.E., gave "Our Guests and Visitors," for whom Mr. C. G. Morley New, city electrical engineer, Cardiff, responded. Mr. R. L. Axford, M.I.Mech.E., proposed the chairman's health.

B.E.A.M.A. and London's Underground

The British Electrical & Allied Manufacturers' Association has published a booklet describing the electrical equipment for London's underground railways. It opens with a history of the Underground railways from 1846, when the prospectus was issued which led to the foundation of the Metropolitan Railway, and it has sections on the electricity supply for the railways, transmission and distribution, sub-stations, rolling stock, lighting and ventilation, escalators and lifts, and miscellaneous plant. The purpose of this book, which is fully illustrated, is to record the part played by members of the B.E.A.M.A. in providing machinery and equipment by which the reputation for reliability and efficiency which the Underground has won has been largely obtained. An appendix gives pertinent facts concerning the Underground railways, and a list of members of B.E.A.M.A. is included.

A Large Hydro-electric Station

Water for the Handeck hydro-electric station is obtained from two artificial lakes situated 6,500 ft. above sea level; one, the Grimsel Lake, has a capacity of 3,500 million cu. ft., and the other, the Gelner Lake, 450 million cu. ft. The lakes are connected and supply water throughout the year. The water has a vertical fall of 1,750 ft. through two 8 ft. dia. pipe-lines to four Pelton-wheel turbines of 30,000 h.p. each, driving four vertical 28,000-kVA, 11-kV, 500 r.p.m. generators. The current is stepped up to 50 kV by four 28,000-kVA transformers; the latter are run in an underground passage to Guttannen, 5 km. away, on account of the avalanches in winter and spring, which would endanger overhead lines. Transmission is overhead from Guttannen to Innertkirchen, where it is stepped up to 150 kV. The underground passage is fitted with an electric car for conveying the engineers to and from the power station in winter. The output of the station for the first year of operation (commencing October 1st, 1932) was 230 million kWh.

Electrical Indicator for Diesel Engines

A new type of continuous optical indicator, due to Dr.-Ing. Hans Rumpff, of Bonn, was demonstrated to members of the German Shipbuilding Association during a recent cruise of the m.s. *Monte Rosa*. According to the *Hamburger Nachrichten*, each cylinder of the main Diesel engine is fitted with a small metal capsule containing three plates of a special material, the composition of which has not been revealed by the inventor. The electrical resistance of this stack of plates varies with the applied mechanical pressure, as in the well-known variable carbon resistance, but according to a definite quantitative law.

This device, which constitutes the indicator proper, is connected electrically in one arm of a 4-V Wheatstone bridge. An oscillograph connected to the bridge gives deflections proportional to the cylinder pressure, and the transverse motion of the spot is obtained by a mirror oscillated in synchronism with the engine stroke. No valve amplifier or other special equipment is required. The Wheatstone bridge and oscillograph can be situated in a central control room and, by means of simple switchgear, can be connected to each engine cylinder in turn. The apparatus can be kept in service continuously at nominal cost and thus permits continual supervision.

Automatic Voltage Control

Mr. W. Kidd, one of the authors of the I.E.E. paper on "Automatic Voltage Control and Supervisory Switchgear," draws our attention to two errors in the report of the discussion on the paper in our last issue. Instead of "£1,200 per annum on a 33-kV sub-station," the wording should be "£1,200 capital cost for a 33-circuit sub-station"; and instead of "6,000 to 8,000 kW per square mile in the City Area," the correct wording should be "68,000 kW per square mile in the City Area."

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Rear-Admiral C. P. R. Coode has been appointed vice-president and general manager of the Western Union Telegraph Co. in succession to Mr. S. J. Goddard, who has retired.

Mr. W. G. Marks, whose appointment as general manager of the Liverpool Corporation transport undertaking was recorded in our last issue, is fifty years of age, and has had thirty-two years' experience in passenger transport work. From 1902 to 1904 he was with the Imperial Tramways Co., of Middlesbrough, and for the next eleven years was with the Rotherham Corporation Tramways Department. He left Rotherham to take up the position of general manager of the Chesterfield Transport Department, where he remained for three years, and in 1929 he went to Nottingham as general manager of the Transport Department of that city. Many important developments have taken place during his term at Nottingham. Powers have been obtained for the complete conversion of all the tramway routes to trolley-vehicle operation, and this conversion is well on the way to completion. The motor-omnibus services have also been considerably extended.

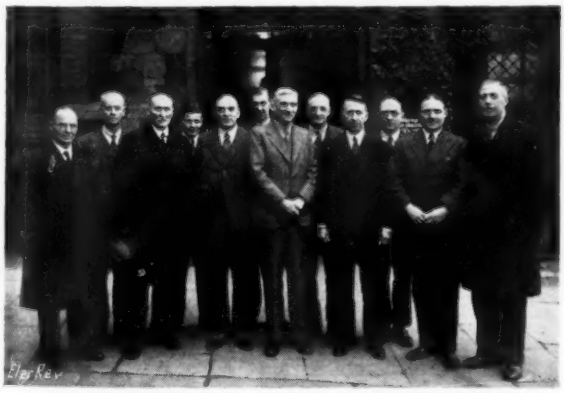
Mr. W. G. Marks

Mr. G. Waterston, of Messrs. Geo. Waterston & Sons, Ltd., Edinburgh, has been appointed a director of Messrs. Wood & Cairns, Ltd., in place of the late Mr. A. Matthew. In March last **Mr. R. K. Hill,** chairman and joint managing director, resigned both offices owing to ill-health, but he remains on the board. Mr. H. Mason is chairman and Mr. J. E. Lamb deputy chairman and managing director of the company.

Mr. F. B. Bell, chief clerk of the Great Yarmouth Corporation Electricity Department, has been appointed commercial assistant at a salary of £350 per annum, rising to £400.

Mr. J. Watt, of the Inverness Electricity Department, was recently presented with gifts by his fellow-employés on the occasion of his marriage. Mr. G. C. M'Lean, chief electrical engineer, made the presentation.

Sir William Noble, a director of the General Electric Co., Ltd., was elected chairman of the Telephone Development



Overseas visitors at the B.T.-H. works

Left to Right: Mr. L. L. Horrell, chief electrical engineer, Pretoria; Mr. F. H. Clough; Mr. F. Fraser; Mr. W. L. M. Horrell; Mr. H. N. Sporborg; Mr. E. G. Taylor; Sir Edward T. F. Crowe, Comptroller-General, Department of Overseas Trade; Mr. P. F. Lloyd; Mr. G. M. Campbell; Mr. R. C. Plowman; Mr. A. P. Young, and Mr. B. F. McMurtrie.

Association at the annual meeting held on December 13th. Sir William succeeds Mr. E. S. Byng, of Standard Telephones & Cables, Ltd.

A *Reuter* message from Athens states that M. Tsaldaris, the Greek Prime Minister, has announced that **Mr. Samuel Insull** will have to leave Greece shortly.

Mr. E. J. Jarrett, sectional engineer for the Newcastle-on-Tyne inner area of the Post Office Telephone Department, has retired after forty-three years' service, and has been presented with a silver salver and jug by his colleagues. He was responsible for the installation of the manual exchange at Sunderland in 1902, which passed out of existence a year ago following the installation of the automatic system. He has held appointments with the Post Office at Dublin, Wolverhampton and Birmingham, and was in charge of the work in 1931 of changing the Newcastle exchanges from manual to automatic operation.

Mr. J. Schartel, technical manager and director of the Electricity Meter Manufacturing Co., Ltd., of Sydney, Australia, has arrived in England on a business visit.

Mr. R. R. Barkes, a principal of the British Electrical & Manufacturing Co., of Newcastle-on-Tyne, who has been travel-

Councillor Southan, chairman of the Wolverhampton Electricity Department, filling in the last cable trench which completed the scheme for the cabling of the whole of Wolverhampton. Mr. T. A. G. Margary, the borough electrical engineer, is seen to the left of the pillar

ling in Australia for some time past, is now in South Africa, where he will spend some months before returning to England. He is accompanied by Mrs. Barkes.

The Great Yarmouth Town Council has rejected a recommendation from the Electricity Committee that the salary of the electrical engineer and general manager, **Mr. P. E. Rycroft,** should be increased by assessing his salary on the total kWh sold, instead of excluding bulk supply kWh as hitherto.

Mr. E. A. Anderson, electrical engineer and manager to the Walton and Weybridge Urban District Council, has had his salary increased from £700 to £800 per annum. The Council has altered the designation of the post held by **Mr. J. D. Francis** to chief commercial assistant, with an increased salary of £310 per annum.

Mr. J. Parkinson was elected president of the Birmingham Electric Club for the ensuing year at the annual meeting of the Club, which was held on December 15th. Mr. Parkinson is well known in engineering circles in the Birmingham district. He received his early training with Messrs. Mather & Platt, Ltd., and for a number of years he has been associated with Tube Investments, Ltd. **Mr. J. H. Asdell** (Veritys, Ltd.) and **Mr. W. E. Clark,** manager of the Midland office of the English Electric Co., Ltd., were elected senior and junior vice-presidents respectively; **Mr. M. J. Penford,** electrical engineer to the Birmingham Tame & Rea District Drainage Board, was appointed hon. treasurer; **Mr. J. Donovan** (Donovan Electrical Co., Ltd.) was appointed hon. social secretary; and **Mr. A. M. Fletcher** (English Electric Co., Ltd.) was re-elected hon. secretary. The report submitted to the meeting showed further progress, and the membership of the Club is now 365.

Mr. J. Parkinson

Mr. C. Buxton, Assistant Superintendent of Telegraphs at the G.P.O., who retired on December 16th after forty-three years' service, was presented with farewell gifts at a concert held on December 11th at the Raglan Hotel, E.C.

Mr. J. Dallas, chief mains engineer of the County of London Electric Supply Co., Ltd., is retiring at the end of the year, though his services will be retained in a consultative capacity. On December 14th a dinner was given in his honour at St. Stephen's Club by a large number of the chief officials of the company, when he was presented with a gold cigarette case as a mark of the esteem and affection with which he is regarded. Mr. J. C. Dalton, the manager and secretary of the company, was in the chair, and in proposing Mr. Dallas's health paid a tribute to his work during his thirty-eight years' association with the company. Mr. W. J. H. Wood, the engineer-in-chief, emphasised the vast knowledge of Mr. Dallas of the intricacies of distribution, and Messrs. H. W. Sprunt, commercial manager, A. R. Bacon, H. C. Wells, D. V. Repton, of the County Co., and Mr. W. J. Allbright, of the South Metropolitan Electric Light and Power Co., Ltd., also spoke. Mr. Dallas was educated at University College, London, and before his association with the County Co. was attached to the Edison General Electric Co., the Thomson-Houston Co. of America, and to the India Rubber, Gutta-Percha and Telegraph Works Co., Ltd. He joined the County Co. as mains superintendent in January, 1895, and became the chief mains engineer in 1919.

Obituary

Mr. G. G. Clarke.—The death occurred recently, in London, of Mr. G. Gould Clarke, secretary of the Braunton Electric Light & Power Co., Ltd.

Mr. R. J. Moore.—The death took place at Oakdene, West Lavington Hill, Midhurst, Sussex, on December 9th, of Mr. Alfred John Moore, late senior electrical engineer, H.M. Dockyard and Admiralty. He was seventy years of age.

Mr. K. B. Miller.—The death occurred in America, on November 22nd, at the age of sixty-three years, of Mr. Kempster B. Miller, a well-known telephone engineer and writer on telephony. He was also connected with various electrical companies in the United States, and was a Fellow of the American Institute of Electrical Engineers.

Col. P. Crowe.—The death occurred on December 12th, at the age of seventy, of Colonel Percy Barby Crowe, late director of Messrs. W. H. Allen, Sons & Co., Ltd., of Bedford.

Will.—Mr. Sydney Prestige, formerly director of Messrs. J. Stone & Co., Ltd., left £74,589, with net personalty £69,741.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Low Tension Systems, Ltd.—Private company. Registered December 13th. Capital: £3,000 in £1 shares. Objects: To carry on the business of electrical contractors, electrical, mechanical, telephonic, wireless and general engineers, manufacturers, importers, and exporters of and dealers in electric clocks, &c. The provisional directors are: J. R. Townley, 195, Queen's Drive, West Derby, Liverpool, and H. R. Brown, 1, Ramsey Road, Allerton, Liverpool, 19. Secretary: J. R. Townley. Registered office: Wellington Buildings, The Strand, Liverpool.

Time Signs, Ltd.—Private company. Registered December 13th. Capital: £500 in £1 shares. Objects: To carry on the business of manufacturers of illuminated time and advertisement projectors, manufacturers and erectors of and dealers in all kinds of electrical and mechanical advertisement signs, &c. The provisional directors are: J. R. Townley, 195, Queen's Drive, West Derby, Liverpool, and H. R. Brown, 1, Ramsey Road, Allerton, Liverpool, 19. Secretary: J. R. Townley. Registered office: Wellington Buildings, The Strand, Liverpool.

Double Life Multiplex Lamp Co., Ltd.—Private company. Registered December 12th. Capital: £5,000 in £1 shares. Objects: To carry on the business of manufacturers of and/or dealers in electric lamps and all kinds of lighting equipment, gas and electrical goods, equipment, installations and accessories, radio goods, automobile equipment, &c. The subscribers are: R. J. Matthews and R. A. Savell, both of 2, Norfolk Street, Strand, W.C.2. Secretary: R. A. Savell. Registered office: Aldwych House, Aldwych, W.C.2.

Mikijohns, Ltd.—Private company. Registered December 14th. Capital, £3,000 in £1 shares. Objects: To carry on the business of inventors, designers and manufacturers of and dealers in electric and other signs, &c. The permanent directors are: M. R. H. Sadler, The Mansion, Church Street, Ashbourne, Derbyshire; and R. E Sadler, 37, The Green Road, Ashbourne, Derbyshire. Solicitors: Holland, Rigby & Williams, Ashbourne.

Edwards Bros. (Birmingham), Ltd.—Private company. Registered December 14th. Capital, £1,500 in £1 shares (1,000 6 per cent. redeemable cumulative preference and 500 ordinary). Objects: To carry on the business of manufacturers of, agents for the sale of and dealers in electric, gas and oil lamps, quartz lamps, reflectors, bells, fires, stoves, cookers, switchboards, irons, dynamos, motors, armatures, contacts, insulators and insulating materials, &c. The directors are: W. Rowley, The Grange, Birlingham, Worcs; C. Bamford, 175, Yardley Wood Road, Moseley, Birmingham; and G. E. Hollyhurst, Water Orton.

Dean, Pickering & Co., Ltd.—Private company. Registered December 11th. Capital: £500 in 1s. shares. Objects: To carry on the business of manufacturers of electrical goods and appliances (including neon signs), and electrical devices and materials; general electricians, &c. The permanent directors are: Mrs. Edith E. Pickering, 26, Laburnum Grove, Hounslow, Middlesex, and F. W. Dean, 7a, Bickenhall Mansions, W.1. Registered office: 72, George Street, Baker Street, W.

J. Tomalin Dear & Co., Ltd.—Private company. Registered December 14th. Capital, £300 in £1 shares. Objects: To acquire the business of a wireless and gramophone manufacturer and dealer carried on by J. T. Dear at 22, George Street, Hanover Square, W. The directors are: J. T. Dear and R. W. A. Dear, both of 17, Woodville Road, Ealing, W.5. Solicitors: Pothecary & Barratt, 73/76, King William Street, E.C.4.

British Crystalite (Dominions), Ltd.—Private company. Registered December 15th. Capital, £250 in £1 shares. Objects: To carry on the business of manufacturers and repairers of and dealers in electric lamps, electrical and wireless apparatus and accessories, &c. The subscribers are: J. Ismay, 10, Warwick Gardens, Ilford; and L. N. Epstein, 4, Cleve Road, N.W.6.

Vita-Rays (Sales), Ltd.—Private company. Registered December 14th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electro-medical and surgical apparatus and appliances of all kinds, electric lamps, radiators, dynamos and batteries, &c. The first director is B. A. Gosling, Sunbury House, 2, Mortimer Place, St. John's Wood, N.W. Registered office: First Avenue House, High Holborn, W.C.1.

Returns of Electrical Companies

Vactite Wire Company (1919), Ltd.—Debenture dated November 30th, 1933, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: T. H. Butler, 136, Fenchurch Street, E.C.3.

R. & W. (Electrical), Ltd.—Particulars filed of £750 debentures authorised November 24th, 1933, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Cetex, Ltd.—The nominal capital has been increased by the addition of £500 beyond the registered capital of £11,000. The additional capital is divided into 10,000 ordinary shares of 1s. each.

Frigidaire, Ltd.—The nominal capital has been increased by the addition of £19,000 in £1 shares beyond the registered capital of £1,000.

Mirrlees, Bickerton & Day, Ltd.—Capital: £600,000 in 100,000 5½ per cent. cum. preference and 500,000 ordinary shares of £1 each. Return dated July 11th, 1933, 71,000 preference and 466,000 ordinary shares taken up. £302,500 paid on 71,000 preference and 231,500 ordinary shares, £234,500 considered as paid on the remainder. Mortgages and charges nil.

Whitehall Electric Investments, Ltd.—Capital, £7,500,000 in 2,500,000 7½ per cent. cum. preference and 5,000,000 ordinary shares of £1 each. Return dated June 29th, 1933. All shares taken up. £2,500,007 paid on 2,500,000 preference and seven ordinary shares, £4,999,993 considered as paid on 4,999,993 ordinary shares. Mortgages and charges: £2,805,248.

Lisbon Electric Tramways, Ltd.—Capital: £1,500,000 in 1,000,000 ordinary and 500,000 6 per cent. cum. preference shares of £1 each. Return dated July 19th, 1933. 948,791 ordinary and 425,553 preference shares taken up. £134,026 paid on 134,026 ordinary shares, £1,240,318 considered as paid on 814,765 ordinary and 425,553 preference shares. Mortgages and charges: £399,800.

H. E. Keen & Co., Ltd.—Capital: £6,000 in £1 shares. Return dated August 23rd, 1933. All shares taken up. £502 paid, £5,498 considered as paid. Mortgages and charges nil.

Wellington District Electricity Co., Ltd.—The nominal capital has been increased by the addition of £15,000 in £1 ordinary shares beyond the registered capital of £30,000.

Exe Valley Electricity Co., Ltd.—The nominal capital has been increased by the addition of £25,000 in £1 ordinary shares beyond the registered capital of £125,000.

National Electric Construction Co., Ltd.—The nominal capital has been increased by the addition of £60,000 beyond the registered capital of £125,000. The additional capital is divided into 120,000 ordinary shares of 10s.

E. K. Cole, Ltd.—Satisfaction in full on November 24th, 1933, of debenture, dated October 11th, 1932, and registered October 17th, 1932. (According to the register of mortgages, the debenture registered October 17th, 1932, originally secured all moneys due or to become due to bank.)

J. Lewtas, Ltd.—R. Sowood, 61, Brown Street, Manchester, ceased to act as receiver on December 11th, 1933.

Alfred H. Hughes & Co., Ltd.—K. Paterson, Avenue Chambers, 4, Howard Street, and 139, Norfolk Street, Sheffield, ceased to act as receiver and manager on December 10th, 1933.

City Notes

Crompton Parkinson, Ltd., held their annual meeting on December 15th, Mr. F. Parkinson (chairman) presiding. In presenting the report and accounts (ELEC. REV., December 1st, page 791), the chairman said the results were a testimony to the high standard of efficiency in manufacture at the various works and to the wisdom of the board's policy in directing the company's activities into those lines of manufacture where new conditions were creating new demands. Coincident with these new developments they were maintaining their productive capacity in the lines of manufacture that were temporarily under the cloud of depression, so that with a return to more

normal trading conditions they would be in a position to take full advantage of increased business when it offered. During the financial period under review they received the allotment of the controlling shares in the British Electric Transformer Co., Ltd., and they had also acquired a further shareholding in Derby Cables, Ltd. In addition, they had acquired control of two more companies. In the past the electrical manufacturing industry in this country had not enjoyed the profit-earning capacity and financial stability commensurate with the technical skill required for its direction and the money invested in the industry. One contributory cause had been the lack of co-operation and co-ordination within the industry. It was of national importance that the British electrical industry should be established on a sound profit-earning basis with adequate financial stability, and the board would sympathetically consider every proposal which would tend to improve the efficiency and profit-earning capacity of the industry as a whole. The first full trading period of the British Electric Transformer Co., Ltd., under their management had now been completed, and as a result of the reorganisation and new management this company had been established on a profit-earning basis. The profits this year had been absorbed in eliminating the debit balance from the previous trading period and in the payment of the dividend on the preference shares. The works at Derby continued to be fully employed, and their heavy mains cables, as well as their rubber insulated and special cables, were meeting with a steadily increasing demand both in this country and abroad. Several large contracts had recently been secured. The works had been reorganised and extensions were in hand to enable them to meet the increased demand. They now owned 99.5 per cent. of the issued share capital of Derby Cables, Ltd. Satisfactory progress continued to be made in the electric traction field, and during the year equipments had been supplied for railway, tramway, trolley-bus, and Diesel-electric traction service. Considerable progress had been made in the manufacture and sale of

on December 18th, Sir H. E. Yarrow, Bt. (chairman), in the course of his speech, said that their boiler department had been kept busy throughout the year and had sufficient work in hand to keep it occupied for several months. More inquiries were being received for boilers from industrial firms, showing increased interest in the marked economies that could be effected by modernised steam generating plants. During the year licences had been granted for the manufacture of Yarrow boilers to certain firms in the United States and Australia.

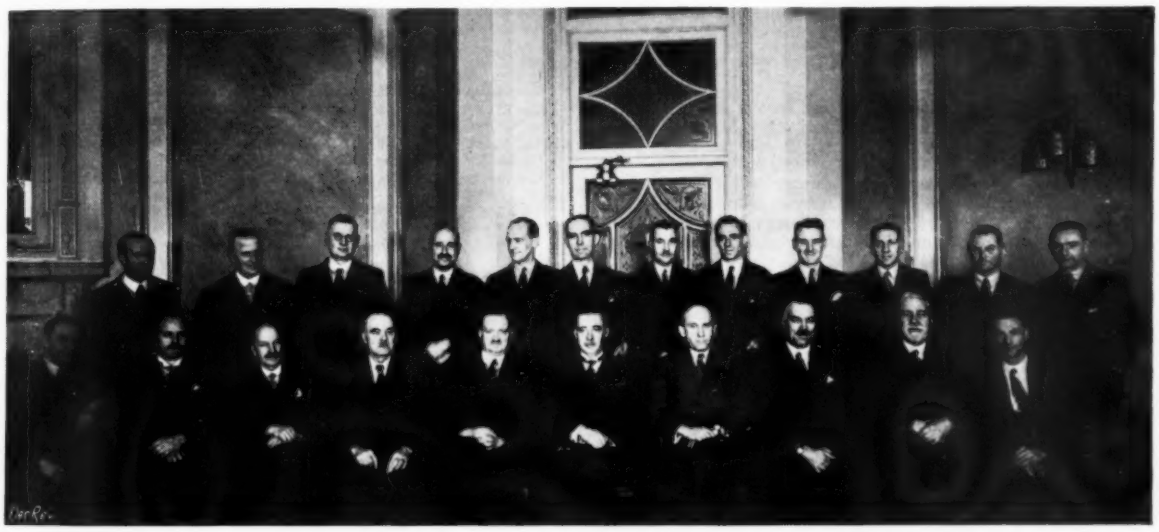
The Associated Equipment Co., Ltd., reports a net profit for the nine months ended September 30th last of £62,384, to which is added £219,593 brought in, making £281,977. A final ordinary dividend of 3 per cent. is paid, making 5 per cent. for the year, leaving £225,727 to be carried forward.

Presiding at the annual meeting held on December 15th, Mr. C. W. Reeve (chairman and managing director) said that among recent developments in the company's main manufacturing activities were the "Q" type omnibus and the "Q" type sixty-three seater electric trolley-bus. Both these vehicles —which had the power units mounted at the side instead of in the orthodox position in front—were well in advance of average modern design and were protected by patents. They presented features which made them eminently adapted for city services.

The East African Power & Lighting Co. proposes to increase its capital to £1,000,000 by the creation of 300,000 additional shares of £1 each. The proposal will come before a meeting to be held in Nairobi on December 29th.

The Anchor Cable Co., Ltd., has given notice of its intention to redeem at 110, on June 30th next, the outstanding 4½ per cent. debenture stock, amounting to £50,000.

Aron Electricity Meter, Ltd., has announced an interim dividend of 4 per cent. No interim was paid last year, but the final distribution was 10 per cent.



Sir William Ray (centre), with Scottish members of E.D.A. during his recent visit to Edinburgh. The group includes Messrs. W. J. Cooper (chairman of the Scottish Area Committee), A. C. Cramb (E.D.A. director and secretary), E. M. Hood (Scottish Area Officer), Lord Provost Thomson (Edinburgh), and Provost Kilgour (Kirkcaldy)

Crompton lamps. They had to-day the largest independent electric lamp business in the world, and were continuously extending the sale of Crompton lamps in the home market and in twenty-four overseas markets. Great progress was being made in the equipment and organisation of their lamp works; the new glass factory had been brought into full commission, and they were now producing the glass requirements of their lamp business. While maintaining the highest standards of quality in the manufacture of Crompton lamps they were able to offer a definite price advantage due entirely to the efficient manufacturing organisation which they had created. The increase in the sale of Crompton lamps, and particularly the large number of repeat contracts they obtained, was a gratifying testimony to the success of the board's policy. To meet the competition of imported lamps they had produced the "Kye" shilling lamp. This was subject to the same careful inspection and tests as the Crompton lamp, but the extremely fine limits of accuracy imposed on Crompton lamps had been relaxed slightly so as to enable them to offer an efficient lamp at a low price. The directors proposed to capitalise £9,988 of the general reserve and to pay a capital bonus of one "A" ordinary share for every twenty existing ordinary shares and/or "A" ordinary shares held. It was the board's intention to recommend a similar bonus distribution each year provided the trading results continued to be satisfactory.

Greenwood & Batley, Ltd., have declared an interim dividend on the preference shares of 3½ per cent.

The Telephone Co. of Pernambuco, Ltd., reports that after charging interest at the rate of 4 per cent. on the 8 per cent. registered debentures and providing £6,603 for difference in exchange, there was a loss for 1932 of £13,494, the debit balance carried forward being increased from £5,153 to £18,647. The loss shown for 1932 is subject to certain adjustments amounting to £586. Had these adjustments been made in the revenue account, the net loss would have been £14,080, as compared with an adjusted net loss of £8,711 for 1931.

Yarrow & Co., Ltd.—Presiding at the annual meeting held

The United River Plate Telephone Co. has declared an interim ordinary dividend of 2 per cent. (against 3 per cent.).

The Lisbon Electric Tramways, Ltd., has declared an interim dividend of 3 per cent., tax free, on the ordinary shares (unchanged).

W. & T. Avery, Ltd., have decided to redeem on January 1st the whole of the 4½ per cent. debenture stock outstanding at 104½ per cent.

British Automatic Refrigerators, Ltd., reports a net profit of £3,043, for the year ended September 30th last, as against £9,164 in the preceding year, to which is added £656 brought in. Depreciation reserve receives £3,000 and £699 is carried forward. The report states that changes have been made in organisation which are expected to yield beneficial results. The directors have agreed to waive half of the fees due to them in respect of the period.

Stocks and Shares

TUESDAY EVENING.

THE main object of Stock Exchange members during the present week has been, so far as personal experience showed, to get away from business as soon as possible, in order to make the necessary Christmas preparations. Observation of the money which is being spent in the West End of London certainly suggests that the trade of the country must be on the mend, for the shops, restaurants, and places of entertainment, are more crowded than ever, and the willingness to spend money is a good deal more marked this season than it has been for some years past, judging, again, from the limited orbit of personal observation. The superabundance of money awaiting investment, to which reference has been made here with, it is feared, monotonous reiteration, is again obvious. British Government stocks are being bought by

people intent upon obtaining a higher rate of interest than that offered by the banks for deposit money.

The various issues of the public boards, of which those in the Central Electricity and the London Passenger Transport groups rank as some of the most prominent, show only one variation in price, but there is comparatively little stock on offer. The stream of small selling common to this period of the year, for the account of people who like to make as good a showing as possible at their banks on New Year's Eve, is scarcely in evidence. Whatever stock comes to market is readily taken. London Passenger Transport "C" stock is 2 points up at 84. The L.G.O.C. is raising the pay of certain of its employés. This is accepted as testimony to the progress of the combine. At 31s. 3d., Associated Equipments are slightly higher.

Home Electricity Supply

North Metropolitan Electrics have been a good market, with a rise to 62s. 6d. The very substantial block of shares that was on offer some weeks ago, at 60s. or thereabouts, has found a permanent home. It might be more correct to say that the shares have gone into many hands, and are now well-distributed throughout the country. Metropolitan Electrics have risen to 53s. 9d. This has had the effect, of course, of making the new shares, offered last month at 40s. each, a better market at a premium of 13s. Scottish Power shares have come into request at 40s., the middle price. The new preference, which holders of the ordinary shares were offered at 24s., touched 5s. premium, and are now a few pence less. West Devon new ordinary remain at 1s. 6d. premium. Clyde Valley shares strengthened to 40s. 9d., and Midland Counties to 37s. 6d. There is an active demand for all the good-class ordinary shares in this list, while as regards the preference, the amount of available supply is extremely limited.

British Power & Light shares are quoted at 20s., and Atlas at 7s. 9d.

Cables and Wireless

The spurt which occurred last week in the stocks of Cables & Wireless had the effect of bringing in a few sellers. The prices of the issues went lower, but the 5½ per cent. preference stock rallied to 75½, leaving it 1 better on the week. Globes are marked ex dividend, the ordinary being 9¼, and the preference 11¾. Something of a feature is a rise of 2s. 6d. to 30s. in Marconi Marines. This followed upon the expectation that the Government is on the point of holding out a hand of assistance to the shipping industry. Prices of shipping shares recovered sharply from the lowest. The industry has been in a parlous condition for some time past, and it is thought in the market that any action which the Government takes may serve to revive the fortunes of the shipping companies. Anglo-American Telegraph preferred stock has strengthened to 114. Of the American issues, American Telephone & Telegraph has shed its gain of last week, going back to 109½, ex dividend. International Telephone & Telegraph rose to 14, but fell back again to 13.

Shares in Manufacturing Companies

The general tendency of prices in the market for manufacturing and equipment shares is very firm. No price changes of outstanding interest have occurred, but there is a steady demand for the shares in the best-known companies. Enfield Rolling Mills dropped from 29s. to 27s. 6d., recovering to 28s. 6d. Ericsson Telephones ordinary shares at 61s. 6d. are better. British Aluminium ordinary moved up a few pence to 27s. 6d. On the other hand, Johnson & Phillips are easier at 18s. 9d. Telegraph Condenser ordinary and preference shares have now met at the same price, 23s. 6d., the preference being ex dividend. London Electric Wire & Smith's ordinary shares are 18s. 6d., the preference 27s. 6d. Hall's Telephone Accessories are a shade harder at 20s. 6d. Aron Electricity Meter has announced an interim dividend at the rate of 10 per cent., less tax, payable to holders of the ordinary shares on January 25th next. There was no interim dividend last year, but for the full year 10 per cent. was distributed, the first, it may be recalled, for several years. The price of the shares is 50s., the 6 per cent. income debenture stock being quoted at 103. British Thomson-Houston are better at 28s. 1½d.

Two Legal Cases

Two legal cases that have been decided during the past few days are of interest to holders of stocks and shares in electricity undertakings. The first concerns the Société Intercommunale Belge d'Electricité, in which a holder of the bonds contended that he had the right to be paid in United Kingdom gold coin equal to the standard of fineness existing on September 1st, 1928. The case has gone through all the Courts, and the House of Lords has decided that the holder of the bonds is right in his claim, and that he is entitled to be paid both principal and interest in the equivalent of gold coin (as on the date mentioned) in the United Kingdom. The second case was that of the Adelaide Electric Supply Company, which concerned payment of the dividends. The company maintained that it had the right to distribute these in Australian, instead of English, pounds, and this the judges have now held to be valid. The price of the company's preference stock stands at about 104, the 5 per cent. "A" preference stock, upon which dividends are paid free of tax, at 102, and the 6½ per cent. "C" preference stock at 110.

Share List of Electrical Companies

	Nom.	Approx. Dividend. 1931.	1932.	Price, Dec. 19.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	78/3	—	3 17 9
Brompton Ordinary	1	8½	7	34/–	—	4 2 4
Charing Cross Ordinary	1	8½	7	34/6	—	4 1 2
Chelsea	1	8½	7	34/–	—	4 2 4
City of London	1	10	10	35/–	—	4 0 0
Clyde Valley	1	7	7	40/9	+9d.	3 9 0
County of London	1	10½	10½	55/9	+9d.	3 15 3
Edmundson's 7% Pref.	1	7	7	34/–	—	4 2 4
Elec. Dis. Yorkshire	1	9	9	46/3	—	3 18 0
Elec. Supply Corporation ...	1	11	11	77/6	—	2 16 6
Kensington Ordinary	1	8	7	34/–	—	4 2 4
Lancs Light and Power	1	7	7	35/–	—	4 0 0
London Electric	1	9	7	34/6	—	4 1 2
Metropolitan	1	10	10	53/9	+⅛	3 14 5
Midland Counties	1	7	7	37/6	+6d.	3 14 8
Mid. Elec. Power	1	8	8	45/–	—	3 11 1
North Eastern Electric Ordinary...	1	6	6	35/–	+1/-	3 8 8
Do. 7% Pref.	1	7	7	34/–	—	4 2 4
Northampton	1	10	10	55/–	—	3 12 9
Notting Hill 6% Pref.	10	6	6	13⅜	—	4 8 11
North Met. Elec. 6% Pref. ...	1	6	6	30/–	—	4 0 0
St. James' and Pall Mall ...	1	8	7	34/–	—	4 2 4
Scottish Power	1	8	8	2	—	4 0 0
South London	1	8½	7	34/6	—	4 1 2
Westminster Ordinary	1	8½	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	18/9	—	8 0 0
Yorkshire Elec.	1	8	8	46/3	—	3 9 2
PUBLIC BOARDS.						
Central Electricity, 1950–70 ...	Stock	5	5	113	—	4 8 6
Do. 1955–75 ...	,,	5	5	114	—	4 7 6
Do. 1951–73 ...	,,	4½	4½	106	—	4 5 0
Do. 1963–93 ...	,,	—	3½	93	—	3 15 2
London & Home Counties, 1955–75	,,	4½	4½	110	—	4 1 10
London Passenger Transport, A...	,,	—	4½	114½	—	3 18 7
Do. do. B...	,,	—	5	118½	—	4 4 5
Do. do. C...	,,	—	—	84	+2	—
West Midlands Joint Elec. 1948-68	,,	—	5	114	—	4 7 6
TELEGRAPH AND TELEPHONES.						
American Tel. & Tel.	$100	9	9	109¼xd.	—6	8 4 4
Anglo-Am. Tel. Pref.	Stock	6	6	114	+½	5 5 3
Do. Def.	,,	1½	1½	29½	—	5 1 8
Cables & Wireless 5½% Pref. ...	,,	2¾	2¾	75½	+1	3 12 10
Do. A 7½% Ord.	,,	Nil	Nil	21½	—	—
Do. B Ord.	,,	Nil	Nil	10½	—½	—
Globe Tel. and T. Ord.	10	Nil	2½	9¾xd.	—4/–	2 11 3
Do. do. Pref.	10	6	6	11⅞	—⅛	5 1 1
Great Northern Tel.	10	20	20	32½	—	6 3 0
Marconi-Marine	1	10	7½	30/–	+½	5 0 0
Oriental Telephone Ord.	1	12	12	3⅛	—	*3 18 4
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref. ...	5	Nil	Nil	3/3	—	—
Do. do. 2nd Pref.	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	6	—	—
British Electric Traction Df. Ord.	,,	5	5	450	—	—
Do. do. Pref. Ord.	,,	8	8	144½	—	5 10 9
Brazil Traction	100	—	—	11	—¼	—
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	102½	—½	4 17 7
Mexico Trams, 5% Bonds ...	—	5	5	27½	—	18 3 8
Mexican Light Common	100	Nil	Nil	5½	—	—
Do. 7% Pref.	100	7	7	11	—	—
Do. 1st Bonds	—	5	5	40	—	12 10 0
Victoria Falls Ord.	1	15	20	5⅛	—	3 19 0
Yorkshire (West Riding) ...	1	Nil	Nil	15/–	—	—
MANUFACTURING COMPANIES.						
Assoc. Elec. Ord.	1	4	4	17/9	—	4 10 4
Do. Pref.	1	8	8	31/3xd.	—1/6	5 2 5
Babcock & Wilcox	1	14	9	39/6	—	—
British Aluminium Ord.	1	5	5	27/3	+3d.	3 14 2
British Insulated Ord.	1	15	15	72/6	—	4 2 8
Brush Ord.	Stock	Nil	Nil	40	—	—
Callender's	1	15	15	63/9	—	4 14 4
Do. 6½% Pref.	1	6½	6½	30/9xd.	—	4 4 6
Crompton Parkinson Ord. ...	5/–	22½	12½	21/3xd.	—	—
Do. 8% Pref.	1	8	8	31/3xd.	+6d.	5 2 5
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	6 2 5
Do. 5% Deb.	Stock	5	5	102½	—	4 17 7
Electric Construction	1	Nil	Nil	10/–	—	—
Enfield Cable Ord.	1	25	25	92/6	—	5 7 5
English Electric	1	Nil	Nil	7/6	—	—
Do. do. Pref.	1	Nil	Nil	11/3	—	—
Ever Ready	5/–	35	35	29/–	—	6 0 8
Ferranti Pref.	1	7	7	28/–	—	5 0 0
G.E.C. Pref.	1	6½	6½	31/–	—	4 3 10
Do. Ord.	1	8	8	42/6	—	3 15 3
Henley's	1	30	30	6½	—	4 17 10
Do. 4½% Pref.	5	4½	4½	5½	—	4 5 9
India-Rubber Preferred	1	—	—	15/–	—	—
Johnson & Phillips	1	5	5	18/9	—9d.	5 6 7
Siemens Ord.	1	7½	6½	20/–	—	—
Telegraph Construction	£1	Nil	Nil	28/9	—	—

* Dividends paid free of Income Tax

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1932

7324. "Television and like apparatus." H. F. Hazell and R. H. Dent. March 11th, 1932. (402076.)
7622. "Signal devices for traffic control." E. A. Hailwood. March 15th, 1932. (402053.)
9629. "Electric control means for internal-combustion engine-electric generator power units." Westinghouse Electric & Manufacturing Co. April 2nd, 1931. (402072.)
11078. "Translating circuits." British Thomson-Houston Co., Ltd. April 17th, 1931. (402089.)
11453. "Thermostatic switches." General Electric Co., Ltd., H. C. Turner and A. Sherwin. April 21st, 1932. (402061.)
13990. "Electric lifts or elevators." W. Wood and W. Wadsworth & Sons, Ltd. May 17th, 1932. (402111.)
14254. "Tuning inductance units." Pye Radio, Ltd., and E. V. Root. May 19th, 1932. (402081.)
14355. "Method of single-phase rectification of alternating electric currents." D. Montague. May 20th, 1932. (402092.)
14564. "High-potential transformers." W. W. Triggs (Ohio Brass Co.). May 23rd, 1932. (402084.)
14592. "Telephone systems." Automatic Electric Co., Ltd., C. E. Beale and I. T. Richards. May 23rd, 1932. (402085.)
14821. "Thief-proof combination electric switch device for use on motor-cars and the like." E. J. Hiscock. May 25th, 1932. (402116.)
14846. "Galvanic batteries." H. W. Brownsdon, R. Chadwick and Imperial Chemical Industries, Ltd. May 25th, 1932. (402117.)
14876. "Radio receivers." Marconi's Wireless Telegraph Co., Ltd., and A. A. Linsell. May 25th, 1932. (402120.)
14877. "Television systems." Marconi's Wireless Telegraph Co., Ltd., H. M. Dowsett and D. L. Plaistowe. May 25th, 1932. (402121.)
14879. "Radio direction-finding systems." Marconi's Wireless Telegraph Co., Ltd., H. M. Dowsett and R. J. Kemp. May 25th, 1932. (402122.)
14880. "Pressure-wave transmitters and receivers incorporating magneto-strictive devices." Marconi International Marine Communication Co., Ltd., and N. P. Hinton. May 25th, 1932. (402123.)
14969. "Electric totalisators." Siemens Bros. & Co., Ltd., and J. H. Broome. May 26th, 1932. (402131.)
15011. "Electrical circuits for producing oscillations of non-sinusoidal wave form for use, for example, with cathode-ray devices." Electric & Musical Industries, Ltd., and M. Bowman-Manifold. May 26th, 1932. (402134.)
15089. "Electrical cut-outs." W. J. Davy. May 27th, 1932. (402135.)
15137. "Ultra-violet testing." A. Callo. May 27th, 1931. (402136.)
15322. "Electric discharge devices." British Thomson-Houston Co., Ltd. May 29th, 1931. (Addition to 14628/32.) (402147.)
16491. "Portable electric lamps." Edison Swan Electric Co., Ltd., W. G. Gregory, F. E. Cutler and J. Eaton (trading as Utility Electrical Co.), R. C. Gorringe and H. W. Gambrell. June 10th, 1932. (Cognate application 24732/32.) (402164.)
16545. "Electric burglar alarms and the like." H. J. Tibbles and Rely-A-Bell Burglar & Fire Alarm Co., Ltd. June 11th, 1932. (402166.)
17095. "Magneto-electric machines." W. Bradford. June 16th, 1932. (402168.)
18958. "Circuit controllers for signs and the like." A. Thomas. July 5th, 1932. (402178.)
19293. "Television and the like systems." Electric & Musical Industries, Ltd., and M. Bowman-Manifold. July 7th, 1932. (402181.)
21756. "Automatic or semi-automatic telephone systems." Ericsson Telephones, Ltd., and L. H. Drysdale. August 3rd, 1932. (402193.)
21811. "Methods and apparatus for the synchronisation of two electro-magnetic oscillations whose frequencies are unstable." H. J. J. M. de R. De Bellescize. October 6th, 1931. (402194.)
24327. "Electric motor control systems." H. K. Ramsden and Associated Electrical Industries, Ltd. August 31st, 1932. (402206.)
24386. "Evacuated electric discharge vessels." M. O. Valve Co., Ltd., and C. J. Smithells. September 1st, 1932. (402207.)
24508. "Electric motor control apparatus." Bailey Meter Co. September 3rd, 1931. (402208.)
24623. "Electric accumulators." Chloride Electrical Storage Co., Ltd., and H. Dean. September 3rd, 1932. (402210.)
25360. "Electric discharge tubes." Telefunken Ges. für Drahtlose Telegraphie. September 11th, 1931. (402214.)
26212. "Apparatus for heating incandescent cathodes in gas discharge devices." Jenaer Glaswerk Schott & Gen. September 22nd, 1931. (402218.)
27988. "Electric motors." British Thomson-Houston Co., Ltd. October 9th, 1931. (402224.)
29458. "Synchronous electric motors." Westinghouse Electric & Manufacturing Co. October 21st, 1931. (402232.)
32044. "Means for cooling high-voltage discharge apparatus." C. H. F. Muller Akt.-Ges. November 13th, 1931. (402242.)
32445. "Temperature control devices." British Thomson-Houston Co., Ltd. November 17th, 1931. (402243.)
36187. "Machines for applying molten sealing material to galvanic batteries." K. Baumgarten and F. Roessler. December 22nd, 1931. (402258.)

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4193. "Insulated electric cables." Liverpool Electric Cable Co., Ltd., and W. J. Terry. February 10th, 1933. (402277.)
6660. "Accumulators." C. J. V. Fery. March 25th, 1932. (Cognate application 6661/33.) (402290.)
6685. "Method of synchronising television receiving apparatus by the transmitter." Radioakt-Ges., D. S. Loewe, and Dr. K. Schlesinger. March 7th, 1932. (402291.)
6770. "Electric switch-operating mechanism." International General Electric Co., Inc. March 5th, 1932. (402292.)
7055. "Electron-discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 1st, 1932. (402294.)
8098. "Internal combustion engine-electric power plants." Sulzer Frères Soc. Anon. March 22nd, 1932. (402304.)
8153. "Methods of operating converters with vapour-filled or gas-filled discharge vessels." International General Electric Co., Inc. March 17th, 1932. (402305.)
9948. "High-frequency transmitting systems." C. Lorenz Akt-Ges. April 5th, 1932. (Cognate applications 9949/33 and 9950/33.) (402316.)
10950. "Electric resistance conductors." British Thomson-Houston Co., Ltd. April 13th, 1932. (402321.)
11363. "Thermionic amplifiers, radio-receivers, and the like." Marconi's Wireless Telegraph Co., Ltd. April 26th, 1932. (402326.)
12493. "Electric tumbler switches." A. Watson. April 29th, 1933. (402331.)
13306. "Control devices for electrically driven following mechanisms." C. Zeiss. May 11th, 1932. (402339.)
13346. "Core for dry battery and process for the manufacture thereof." K. Bud. May 8th, 1933. (402340.)
13485. "Electric transformers." British Thomson-Houston Co., Ltd. May 10th, 1932. (402341.)
16553. "Electric current interrupters." L. J. Armstrong. June 9th, 1933. (402351.)
16774. "Impulse-transmitting apparatus for automatic telephony systems." A. Boye. June 14th, 1932. (Addition to 381532.) (402355.)
17574. "Manufacture of cones for loud-speakers and other purposes." A. S. Millbourn, and A. Millbourn Co., Ltd. June 20th, 1933. (402357.)
20236. "Microphones." General Electric Co., Ltd., and C. C. Puckette. July 18th, 1933. (402367.)
20293. "Loud speakers." D. A. Drew and British Blue Spot Co., Ltd. July 18th, 1933. (402368.)
22184. "Thermostatic switches." British Thomson-Houston Co., Ltd. August 6th, 1932. (402373.)
23535. "Radio-receiving apparatus." Westinghouse Brake & Saxby Signal Co., Ltd. August 25th, 1932. (402376.)
27739. "Television and like apparatus." H. F. Hazell and R. H. Dent. March 11th, 1932. (Divided application on 402076.) (402069.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 13th:—

Filtron, No. 546075, and Filt, No. 546076. Class 6. Scientific and philosophical instruments and apparatus for useful purposes.—Graham Farish, Ltd., 153, Mason's Hill, Bromley, Kent.

Protex. No. 543887. Class 13. Insulated electrical connections for electric irons.—Henry Allday & Son (1922), Ltd., 19-21, Warstone Lane, Birmingham.

Benflux, No. 546120, and Coolicon, Ntd. 546121. All goods in Class 14.—Benjamin Electric, Ltd., Tariff Lane, Tottenham, N.17.

Cobena. No. 544389. Class 50. Electric insulating materials of asbestos, mica, resin, oils or bitumen, &c.—Baxendale & Co., Ltd., Miller Street, Manchester.

Alloprene. No. 540020. Class 50. Electrical insulating materials (asbestos, mica, resin, synthetic resin, oils or bitumen), electrical insulating varnish, &c.—Imperial Chemical Industries, Ltd., Millbank, S.W.1.

Laboratory Magnets

SCIENTIFIC investigations, particularly those related to atomic bombardment and the transmutation of matter, often involve the production of extremely intense magnetic fields, necessitating the use of electro-magnets of special design. For about twenty years past Oerlikon, Ltd., has been building magnets of this type, according to the data of Prof. P. Weiss, and a specially interesting equipment is that installed some little time ago at the Royal Society's Mond Laboratory of the University of Cambridge, which can give a field of 350,000 gauss for about 1/50 sec., the time being limited by the heating of the coil that has to dissipate, under such conditions, 30,000 kW. Another laboratory magnet recently supplied is one for the University of Vienna, which is designed for a field of 50,000 gauss, the magnet being specially required for a series of tests during which the field current was to be reversed once every minute for a period of eight hours daily. In the general design of such magnets the object aimed at is to ensure, so far as is possible, easy access to the gap on all sides. This is achieved by adopting a horse-shoe shape of magnet. The magnetic circuit is dimensioned in such a way that, even with high values of excitation, magnetic saturation only occurs in the neighbourhood of the pole tips; the ampere-turns required for the core are thus reduced to the minimum. At the same time, the leakage is small, so that instruments that may be placed in the neighbourhood are practically unaffected. The air gap is adjusted by shifting the cylindrical pole cores by means of a screw handle. In view of the great variety of magnetic investigations that may have to be carried out, various shapes of pole tips are provided. The windings consist of copper tube through which cooling water flows; in this way, it is possible to obtain very energetic cooling. The windings for such magnets are normally designed for 100,000 ampere-turns.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alloa.—Extensions to factory for Patons & Baldwins; the manager.

Ayr.—Houses (£2,000); Alex. M'Lean, builder. Houses (33), Heathfield Road (£14,850), for William Paton & Sons, Ltd., 15, Kyle Street.

Accrington.—Town Hall extension; borough engineer.

Ashton-under-Lyne.—Labour exchange, Old Square, for H.M. Office of Works, King Charles Street, London, S.W.

Bakewell.—Houses (20), Northwood Lane, Darley Dale (£7,000), for the Peak Dairies, Ltd., Dale Road North, Darley Dale; Secretary to the Co.

Birmingham.—Factory premises, Loveday Street (£6,000), with electrical work; W. C. Skinner, builders, 316, Birchfield Road.

Boston.—Re-erection of factory, Witham Town, for the East Anglian Preserving Co., Ltd.

Brighton.—Houses (30) and shops, Carden Avenue, Patcham, and buildings, North Street (£20,000); Braybons, Ltd. Houses (403), Manor Farm Estate, and hall, Moulsecomb (£3,000); borough engineer. Bank premises, London Road (£15,000); borough surveyor. Block of flats; F. T. Wilson & Sons, builders. Premises, Old Steine and St. James's Street; Clayton & Black, architects. Church, Ladies Mile Road, Patcham; A. H. T. Turner. News theatre, Hotel Metropole, King's Road; Gordon Hotels, Ltd. Post office, &c., Old Steine, and alterations to West Pier; Clayton & Black, architects. Ten shops, The Avenue, Bevendean; W. A. Gates & Sons, Ltd. Swimming bath, West Street; Brighton Sports Pool, Ltd. Rebuilding, 45, Cheapside, and 30, Belmont Street; A. J. Smith.

Bristol.—Cinema, Bedminster (£25,000), with electrical work; F. J. Honeyfield, builders, Winterstoke Road.

Bromley.—Houses (22), Blackbrook Lane; E. Tyler & Sons.

Burton-on-Trent.—Factory, Milton Street, for Marmite Food Extract Co., Cross Street (£10,000), with electrical work; Henry Edwards, Ltd., builders, Blackpool Street.

Carlisle.—Estate development, Currock Road; J. Laing & Sons, Ltd. Alterations to Warwick Road for the Provincial Insurance Co.; Irving Graham.

Carluke.—Drapery stores (£8,000), for the Co-operative Society; secretary.

Caterham.—Church, Woldingham Road; United Methodist trustees.

Cheshire.—School, Oldfield Brow, Altrincham, for County E.C.; director of Education, Chester.

Chester.—Houses (12), Granville Road; E. Kennerley. Works extensions, Sealand Road; Crossville Motor Services, Ltd. Rebuilding, 6, Queen Street; Mackay & Sons.

Chislehurst.—Church, Petts Wood; G. Mullins, architect, 5, Verulam Place, London, W.C.

Colchester (ESSEX).—Houses (54) for the staff; Severalls Mental Hospital (£18,090); J. Stuart, county architect, Chelmsford.

Croydon.—Houses (116), Gladeside Estate; E. & L. Berg, Ltd. Houses (90), Ham Farm Estate (£39,000); borough engineer. Houses (40), Oak Avenue; Chart, Son & Reading. Shops, 54-60, Lansdowne Road; C. E. Hanscomb, architect. Five shops and flats, Old Town; H. Sadler. School, Goodwin Road (£11,111), for Borough E.C.; Horace Newby & Co., builders, Burnt Ash Road, Lee, S.E. School, Shirley; H. H. & F. Roll, Ltd., builders, High Street, Epsom. Extensions, Barnacle Works, Bensham Lane; Truett & Steel, Ltd.

Dalkeith.—Houses; T. Aikman Swan, 7, St. Colne Street, Edinburgh.

Darvel.—Houses (£8,500); burgh surveyor.

Dudley.—Schools, Blower's Green Road (£11,628), Halesowen Road, Netherton (£21,000), Priory Estate (£24,000), and Wren's Nest (£18,000), for Borough E.C.; director of education.

Dundee.—Houses, Forthill Road and Traill Street, for the Hillside Property Investment Co., Ltd.; W. M. Wilson, 61, Meadowside.

Edinburgh.—Houses (1,500), five year plan; F. J. M'Rae, City Chambers, High Street.

Exeter.—Two elementary schools (£21,500) for E.C.

Glasgow.—Church, Carntyne Road; Rev. W. H. Harrowes, Presbytery of Glasgow. Ward, operating theatre and laboratories, Western Infirmary, and additions to Pathological Institute; John Burnet, Son & Dick, architects, 16, Blythswood Square. School, Dixon Avenue; Master of Works, Education Offices, Bath Street. School, Keppoch, for E.C. Extensions, St. Peter's School (£14,000); Education Director and trade contractors.

Grantham.—Children's homes; C. B. Medcalfe, architect, County Offices, Sleaford.

Great Barr (NEAR BIRMINGHAM).—Houses (36), and shops, Birmingham Road; Dickinson & Holford, builders, Walsall.

Great Yarmouth.—Canopy, Regal Theatre; Regal Theatre, Ltd.

Greenock.—Houses (2,226), Fancy Farm; R. Millar, borough surveyor, Municipal Buildings.

Halesowen.—Houses (44), Feldon Estate for Stubbs Bros. Houses (28), Oak Tree Crescent, for J. H. Hayward.

Halstead (ESSEX).—Houses (20); U.D.C. surveyor.

Hampton.—Four shops and houses, High Street; Berkeley, Ltd.

Harborough Magna.—Extension to hospital administration block and cottages, Rugby Joint Hospital Board; borough surveyor, Benn Buildings, Rugby.

Herne Bay.—Bathing pool, Hampton (£50,000); U.D.C. surveyor.

Horbury (NEAR WAKEFIELD).—Houses (20); W. Sugars, architect, Town Hall.

Horsham.—Houses (25); R.D.C. surveyor.

Hyde.—Houses (12), Foxholes Estate; G. & S. Ridgway.

Inverkeithing.—Houses (20); R. H. Motion, Union Bank Chambers, Dunfermline.

Irish Free State.—(CO. WICKLOW).—Technical school, Carnew, for C.C.; Mr. Caffrey, architect.

Kendal.—Houses (120), Sandylands, for the Kendal & District Housing Society; secretary.

Kent.—Schools, Poverest Road, St. Mary Cray, for County E.C.; director of education, Maidstone.

Kilmarnock.—Block of shops, Waterloo Street, for W. M'Crone.

Kirkcaldy.—Maternity hospital (£9,776); Williamson & Hubbard, architects.

Lancashire.—Senior schools, Yewlands Drive, Leyland, for County E.C.; education architect, Preston.

Lincoln.—Houses, Bracebridge Hall Estate; city surveyor. New wing for nurses' home, County Hospital Board of Management; W. G. Watkins, architect, St. Edmunds Chambers, Silver Street.

London.—(EALING).—Extensions, Uxbridge Road, for the Ealing Direct Coaches, Ltd.; Mrs. S. H. West, architect. (HACKNEY).—Block of flats, Upper Clapton Road; L. M. Gates for A. E. Knowlson. (KENTISH TOWN).—Rebuilding business stores, 114-118, Kentish Town Road, N.W., for A. Marsh & Co., Ltd. (NORWOOD).—Eight shops and flats, South Norwood Hill; E. F. Bates. (ST. JOHN'S WOOD).—Block of flats, Wellington Road and Circus Road; Ward, Hoare & Wheeler. Cinema and shops and flats, Finchley Road; R. Anderson. (ST. MARYLEBONE).—Block of flats, Albert Road; Wills & Kaula. Buildings, 38-40, Beaumont Street; W. A. Lewis & Partners.

Luton (BEDFORDSHIRE).—Houses (245), Knowles Green; Charles Jeyes, Ltd., builders, 27, Windsor Street.

Market Drayton.—Houses (40); U.D.C. surveyor.

Maybole.—Houses (24); J. M. Johnstone, architect.

Middleton (LANCS).—Houses (44), Holden Fold Lane; borough surveyor.

Motherwell.—Houses (960); burgh surveyor.

Newport (I.O.W.).—County Hall (£50,000) with electrical work; Gutteridge and Gutteridge, architects, 9, Portland Street, Southampton.

Norwich.—Reconstruction of stores, Cowgate and Magdalen Street; Co-operative Society, Ltd.

Oldham.—Houses (72), Collier Hill; borough surveyor.

Pontefract.—Alterations to 26, Market Place; Montague Burton, Ltd.

Portobello.—Bathing pool, ground adjacent to electricity power station, for Edinburgh T.C. (£7,500); E. J. MacRae, City Chambers, High Street, Edinburgh.

Portsmouth.—Estate development, Court Lane, Cosham; Bailey & White, Ltd. School, Farlington, for E.C.

Redruth (CORNWALL).—Cinema, the Square (£20,000), with electrical work; L. Winn, architect, 27, Boscawen Street, Truro.

Rochester.—Houses (24); city surveyor.

Romford.—Houses (24), Saffron Road, for H. Brawshaw. Houses (22), The Avenue, for S. W. Sweetman.

Shirley.—Houses (30), Shirley Way; Gower Builders, Ltd.

Shoreham.—Aerodrome development (£39,000); Brighton, Hove and Worthing Corporations; S. H. Tiltman, architect.

Solihull (NEAR BIRMINGHAM).—Fire station, Streetsbrook Road (£3,000), with electrical work; Wm. Jackson (Langley Green), Ltd., builders, Langley Green, Birmingham.

Southall.—Houses (47), Scotts Road; General Housing Co. Houses (41), Selby Gardens; G. Wimpey & Co., Ltd. Eight shops, South Road; Best & Beach.

South Shields.—Houses (55) and flats, Banbury Terrace; Henderson Bros. Houses (12), Reading Road; R. C. Shewman. Houses (11), Sunniside Drive; J. T. Armstrong & Son. Conversion of old St. John's School into training centre and tramway offices and car depôt (£2,000); borough engineer.

Sowerby Bridge (YORKS).—Catholic church (£5,000); Rev. Father P. J. Kealy.

Soyland (YORKS).—Houses (18) and bungalows, Kebroyd, for W. Parker.

Spalding.—Houses (50); U.D.C. surveyor.

Stockton-on-Tees.—Houses; Fordy & Son and Lane, Fox & Co.

Stratford-on-Avon.—Rebuilding cinema for the Shakespeare Memorial Theatre (£20,000) with electrical work; C. Bryant & Sons, builders, Whitmore Road, Birmingham.

Stroud (GLOS).—Houses (20); U.D.C surveyor.

Sunbury-on-Thames.—Houses (24) and shops, French Street and Staines Road, for W. Myring.

Swindon.—Factory extensions, Sheppard Street; E. W. Beard.

Tewkesbury.—Cinema, the Cross (£12,000), with electrical work; Collins & Godfrey, builders, Grosvenor Street, Cheltenham.

Tynemouth.—Houses (86), Ridges Estate (£28,613); L. W. Evans.

Waddon.—School, Goodwin Road (£11,111); Horace Newby, Ltd.

Wallasey.—Schools, East Way and Douglas Drive, Moreton, for Borough E.C.; director of education.

Wantage.—Houses (40); U.D.C. surveyor.

West Riding.—School, Flockton, for County E.C.; director of education, Wakefield.

Whickham-on-Tyne.—Houses (28); J. H. Moore, builder, Whickham.

Whitby.—Houses (42), Rose Avenue Estate, for R. A. Wilson & Sons.

Wigan.—Labour exchange, Bishopgate, for H.M. Office of Works, King Charles Street, London, S.W.

Willington (DURHAM).—Houses (50); J. H. Gardner, U.D.C. surveyor.

Wilton (WILTS).—Senior church schools; Bothams & Brown, architects, Chipper Lane, Salisbury.

Woodford.—Houses (25); Nightingale Farm; Estate Co.

Woodstock.—Church schools, Hensington Without, for the managers; secretary.